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XVII
A REVISION OF THE GENUS ORTHOCARPUS

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INTRODUCTION

The studies on which this paper is based were carried on in the herbarium at Pomona College under the direction of Dr. Philip A. Munz to whom I am indebted for generous help and suggestions. In addition to the specimens in the Pomona College Herbarium (Po), there was available material from the Gray Herbarium (G), Rocky Mountain Herbarium (RM), State College of Washington Herbarium (WS) and the Herbarium of Willamette University.

After the work at Pomona College was completed there was opportunity to make those additions and corrections found advisable after a study of the material in the Herbarium of the California Academy of Sciences (CA), Herbarium of the University of California (UC), and the Dudley Herbarium of Stanford University (St). Miss Alice Eastwood, of the California Academy of Sciences, kindly loaned me her valuable notes on this genus and Dr. H. M. Hall, of the Carnegie Institution of Washington, gave various helpful suggestions and criticisms. Several other botanists have kindly sent specimens or valuable notes which have been of much aid in this study. To all of these I wish to express my appreciation. Particular

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thanks are due to the curators of each of the above mentioned herbariums for the privilege of examining or borrowing material. The abbreviations indicated in the above parentheses are those used in citing specimens. In most cases only a part of the collections studied have been cited.

RELATIONSHIPS BETWEEN ORTHOCARPUS AND ALLIED GENERA

In revising the genus *Orthocarpus* it was found that two major divisions have been recognized. The annuals constitute one definite group and include most of the described species. The longer-lived ones make up the other division. Several apparently distinct species have been described in this latter group most of which have been referred at one time or another to *Castilleja*. These I propose to incorporate in *Castilleja* because of their evident relationship. A gradual series can be arranged, leading from *O. pilosus* Wats., and *O. pallescens* Gray, two species most persistently grouped with the genus *Orthocarpus*, through *O. psittacinus* Eastw., *C. longispica* Nels., *C. ambigua* Jones, etc., to undoubted species of *Castilleja*, whereas there is an abrupt break between any of these and the other species of *Orthocarpus*. *Orthocarpus pallescens* Gray, has a moderately large, somewhat saccate lower lip, exceeded by the galea by about 3 mm. in which respects it resembles *Orthocarpus*, but in its calyx with two bifid lobes and in its perennial habit it is like *Castilleja*. It has been transferred to *Castilleja* by Greenman. *Orthocarpus parryi* Gray, is a synonym. *Orthocarpus pilosus* Wats., transferred to *Castilleja* by Rydberg, has the characteristic calyx and corolla of *Orthocarpus* except that the lower lip is very shallow. Its habit is like *Castilleja*. *Castilleja ambigua* Jones, appears very similar to *O. pallescens* but is more clearly a *Castilleja* because of the wide galea, flat lower lip and the long calyx which nearly equals the corolla. *Orthocarpus psittacinus* Eastw., belongs here and should be referred to *Castilleja* for the flat lower lip with three long teeth is a characteristic of this group. It is close to *O. pilosus*. The calyx is 4-cleft into subequal lobes in which respect it resembles *Orthocarpus*. Apparently on account of this calyx character Jepson has placed

C. cinerea Gray, and *C. schizotricha* Greenm., in *Orthocarpus*. The floral characters and habit label these positively as *Castillejas*, especially *C. cinerea*, which has a typical *Castilleja* corolla with short lower lip. The variation in calyx lobing is very marked. One of these transitional species, *C. breviflora* Gray, has a rather trisaccate lower lip recalling *Orthocarpus*, but of the calyx Gray says: "the calyx in flowers of the same spike is sometimes about equally cleft behind and before, and sometimes split in front while the posterior cleft is no deeper than that between the lateral lobes."—*Am. Jour. Sci.*, ser. 2, 34:338, 1862. Closely allied species such as *C. lutea* Heller, *C. longispica* Nels., *C. flava* Wats., are undoubted *Castillejas*. The corolla characters and bifid calyx of *O. mexicanus* Hemsl., make it a *Castilleja*. Several other *Castillejas* have been described which are in this group. Among them *C. arachnoidea* Greenm., has been transferred to *O. pilosus* var. *arachnoideus* Jepson. Since all of the above-named species are perennials another bond of relationship is demonstrated between them and *Castilleja* in which genus the perennial character predominates, whereas in true *Orthocarpus* the species are all annual.

Orthocarpus beldingi Greene, has been put into a new genus as *Clevelandia beldingi* Greene. It is generically distinct in having a curved, funnel-formed corolla with lower lobes spreading, not saccate, and in having the stamens included in the tube.

The genus *Orthocarpus* as here restricted includes annual herbs with calyx tubular-campanulate, 4-cleft, or cleft before and behind and the divisions 2-lobed; corolla tubular, the galea narrow, not greatly (or not at all) exceeding the conspicuous, inflated lower lip.

REVIEW OF LITERATURE ON ORTHOCARPUS

The genus *Orthocarpus* was first described by Nuttall, *Gen. Am.* 2:56, 1818. The name came from two Greek words meaning "straight-fruit" to distinguish this genus from *Melampyrum*. Nuttall's type species was *luteus* which he very carefully described. In 1835 the second contribution to this genus was published by Bentham, *Scroph. Ind.* 12-13, 1835, in a synopsis in which he described eleven new species and

made one new combination. Among the early contributions of particular value are those of Bentham, Pl. Hartw. 329-330, 1839, Walpers, Repert. 3:392-393, 1845, Bentham in DC. Prod. 10:534-537, 1846, Watson, Bot. King's Exp. 457-459, 1871, Gray, in Bot. Calif. 1:575-580, and 2:475-476, 1876, Gray, Syn. Fl. 2:299-302, 1878; 2:452-453, 1886. Watson's treatment, above mentioned, is the most recent synopsis of the genus although Gray's account in the Synoptical Flora is complete for the known North American species. Some fifty-five species have been described to date by various authors. The sections for *Orthocarpus* first appeared in Bentham and Hooker, Genera Plantarum 2, pt. 2:974, 1876, and their treatment has been generally followed up to the present time.

PHYLOGENY WITHIN THE GENUS

Within the genus *Orthocarpus* as above limited I propose to recognize twenty-five species, all annuals, of which one is from the Andes Mountains of South America, the other twenty-four from Western North America.

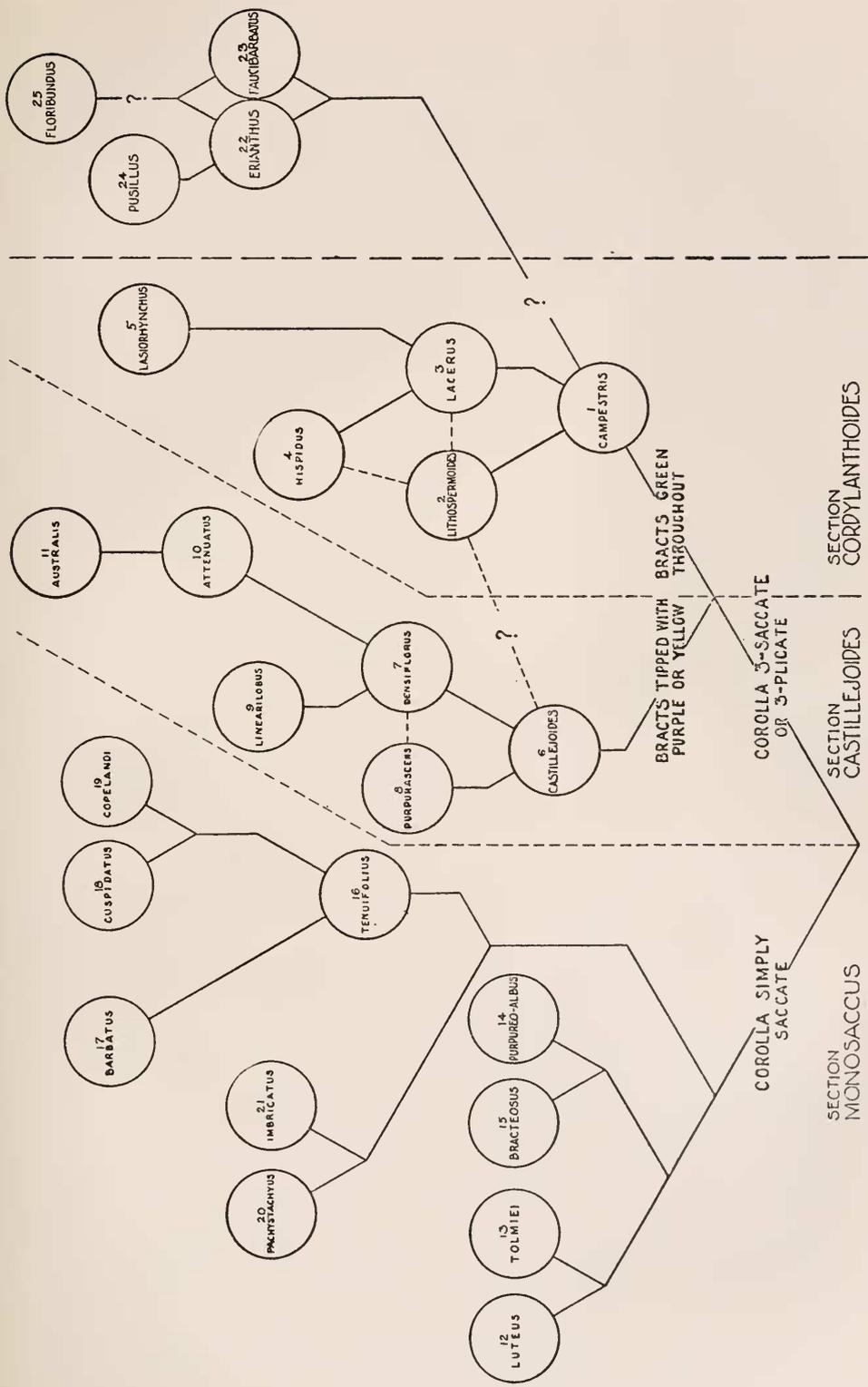
Three sections have been recognized by Gray, in Bot. Calif. 1:575, 577, 578, 1876, who followed Bentham and Hooker, Gen. Pl. 2. pt. 2:974, 1876, except that he placed the section *Oncorhynchus* (Lehm.) Benth. & Hook., under a new section *Castillejoides*. This treatment has been accepted by subsequent writers. However, I have found that his section *Triphysaria* contains two clearly marked groups and I would propose a new nomenclature recognizing two subgenera, one containing three sections, as follows:

- I. Anthers 2-celled. Subgenus **Euorthocarpus* (Benth. & Hook.) n. comb.
 - 1. Bracts green throughout; lower lip 3-saccate.
Section 1. *Cordylanthoides* n. sect.
 - 2. Bracts colored at tips; lower lip 3-saccate or 3-plicate.
Section 2. †*Castillejoides* Gray.
 - 3. Bracts colored at tips; lower lip simply-saccate.
Section 3. *Monosaccus* n. sect.
- II. Anthers 1-celled.
Subgenus ‡*Triphysaria* (F. & M.) n. comb.

* Section *Orthocarpus* Benth. & Hook. Gen. Pl. 2. pt. 2:974, 1876.

† *Castillejoides* Gray, in Bot. Calif. 1:575, 1876.

‡ Genus *Triphysaria* Fisch. & Meyer, Ind. Sem. Hort. Petrop. 2:52, 1836.



SUBGENUS TRIPHYSARIA
ANTHERS 1-CELLED

SUBGENUS EUORTHOCARPUS
ANTHERS 2-CELLED

Figure 1. Phylogenetic Chart of the Species of *Orthocarpus*

The accompanying phylogenetic chart graphically represents the writer's conception of the genus. The subgeneric line drawn does not separate two divergent primitive lines of development but rather points out that one group of four species has progressed far beyond its probable ancestral origin. These four species compose the small subgenus, *Triphysaria*, characterized principally by the one-celled anthers, which is a return to the original conception for the genus of that name. In addition, each species within it has developed unique floral characters that should be considered highly specialized. To name a few of these we have the deep sacs of the lower lip and the long filaments of *floribundus*, the unique diminutive corolla of *pusillus*, the narrow sharp galea of *erianthus* and *floribundus*. It is highly probable that these species had their origin from such a species as *campestris* in the section *Cordylanthoides* which is remarkable in having the lower cell of the anther vestigial, indicating a reduction in this organ.

The subgenus *Euorthocarpus* includes all those species bearing two-celled anthers. The sections *Cordylanthoides* and *Castillejoides* compose one large group as opposed to the section *Monosaccus*. The more primitive of these is *Cordylanthoides*, named after the genus *Cordylanthus* which it resembles in having the bracts green throughout. Its five species are closely related and are all yellow-flowered except for one white-flowered variety under *lithospermoides*. The members of the section *Castillejoides* are suggestive of these differing principally in having bracts with colored tips. The six species found here, in addition to the colored spike, have a greater development of the teeth on the lower lip than those of the first section. One of these species, *O. castillejoides*, shows an abundant variety of forms and is apparently in a very active state of evolution. It is closer to the genus *Castilleja* than the other species of *Orthocarpus* and perhaps there is a connection of the two genera through this species. From *castillejoides* the other species of the section have probably been derived. The third section of this subgenus with its ten species differs from the others in having a lower lip of one sac. The name, *Monosaccus*, refers to this characteristic. Another striking difference that is noticeable in all these species except *luteus*, *tolmiei*

and *purpureo-albus*, is in the bracts which are abruptly different from the leaves in being very broad, often highly colored, and in most cases chartaceous.

KEY TO THE SPECIES

- A. Anthers 2-celled.....Subgenus *Euorthocarpus*
- B. Corolla more or less 3-saccate; seed coat loose-fitting (tight-fitting in *O. campestris*).
- C. Bracts green throughout; corolla deeply 3-saccate; galea equaling or barely exceeding lower lip; teeth inconspicuous.....§*Cordylanthoides*
- D. Lower cell of anthers $\frac{1}{4}$ or $\frac{1}{2}$ as long as upper cell; bracts entire.....1. *O. campestris*
- DD. Lower cell of anthers not less than half as long as upper cell; bracts cleft into linear or lanceolate lobes.
- E. Galea finely pubescent or puberulent, not white-villous.
 - F. Lower lip of corolla 5-8 mm. wide...2. *O. lithospermoides*
 - FF. Lower lip of corolla 4 mm. wide or less.
 - G. Ventral margins of galea pubescent; sacs of lower lip 3-5 mm. deep; pistil usually equaling galea.....3. *O. lacerus*
 - GG. Ventral margins of galea glabrous; sacs of lower lip ca. 2 mm. deep; pistil not equaling galea.....4. *O. hispidus*
 - EE. Galea densely white-villous.....5. *O. lasiorhynchus*
- CC. Bracts tipped with purple or yellow; galea exceeding lower lip; teeth erect.....§*Castillejoides*
- D. Corolla wider above, lower lip more than 2 mm. deep; spike usually conspicuous, wider than the spread of leaves.
- E. Stems pubescent or nearly glabrous; spike showy.
 - F. Galea nearly straight, pubescent.
 - G. Leaves oblong, more than 3 mm. wide, entire or with rounded teeth; stems usually ascending; older plants tend to form mats with many long ascending stems. Saline situations.....6. *O. castillejoides*
 - GG. Leaves lanceolate, less than 3 mm. wide, with lanceolate divisions, attenuate; stems erect.....7. *O. densiflorus*
 - FF. Galea hooked at tip, densely bearded on back; stems purple.....8. *O. purpurascens*
 - EE. Stems villous-pubescent above; spike pale. Sierra Nevada foothills.....9. *O. linearilobus*

- DD. Corolla linear, lower lip 2 mm. or less deep; teeth $\frac{1}{3}$ as long as lower lip; spike rather inconspicuous.
- E. Corolla whitish; bracts tipped with yellow; spike slender.....10. *O. attenuatus*
- EE. Corolla purplish; bracts tipped with purple; spike wider. Andes Mts., S. Am.....11. *O. laciniatus*
- BB. Corolla simply saccate or nearly so; seed coat tight-fitting or ridged.....§Monosaccus
- C. Bracts and calyx strongly glandular-pubescent; bracts gradually differing from upper leaves (except in *bracteosus*); style glabrous under the microscope.
- D. Corolla yellow.
- E. Leaves pubescent; corolla pubescent; galea terminating in a minute hook.....12. *O. luteus*
- EE. Leaves puberulent; corolla glabrous; galea inflexed, cucullate at tip.....13. *O. tolmiei*
- DD. Corolla white or purplish.
- E. Bracts linear, middle lobe 1.5-2 mm. wide; leaves dark green. Rocky Mts.....14. *O. purpureo-albus*
- EE. Bracts lanceolate, middle lobe 2.5-3 mm. wide; leaves light green. Northwest coast.....15. *O. bracteosus*
- CC. Bracts and calyx not glandular-pubescent; bracts abruptly differing from upper leaves; style finely pubescent under the microscope (glabrous in *barbatus*).
- D. Galea pubescent, even at tip.
- E. Lower bracts prominently margined with flattened white hairs; galea distinctly hooked; leaves filiform or filiform-lobed, gray-green16. *O. tenuifolius*
- EE. Lower bracts not prominently margined with hairs; galea straight or curved; leaves linear-lanceolate or linear-lanceolate-lobed, deep green (*barbatus* with leaves and bracts as in *tenuifolius*).
- F. Galea straight, triangular, tip bearing a bearded tuft of hairs.....17. *O. barbatus*
- FF. Galea curved, margins inrolling, tip pubescent.
- G. Corolla 20-25 mm. long; galea exceeding lower lip by 3-5 mm.....18. *O. cuspidatus*
- GG. Corolla 12-15 mm. long; galea equaling or exceeding lower lip by less than 2.5 mm.....19. *O. copelandi*
- DD. Galea puberulent, glabrate at very tip.

- E. Corolla 20-30 mm. long; tip of galea inflexed 1 mm., galea surpassing lower lip 2.5-3 mm.20. *O. pachystachyus*
- EE. Corolla 10-18 mm. long; tip of galea inflexed 0.5 mm., galea surpassing lower lip ca. 1 mm.21. *O. imbricatus*
- AA. Anthers 1-celled.....Subgenus *Triphysaria*
- B. Stamens shorter than galea; each lobe of lower lip less than 1.5 times deeper than long.
- C. Branches divergent from the erect central axis; flowers showy, usually conspicuously exerted; galea straight or gradually curved; bracts pinnatifid.
- D. Galea purple, herbage pubescent.....22. *O. erianthus*
- DD. Galea yellowish, herbage glabrous, or puberulent within inflorescence.....23. *O. faucibarbus*
- CC. Branches many, weak, ascending from the base; central axis indistinct; flowers minute, inconspicuous; galea sharply curved; bracts often bipinnatifid24. *O. pusillus*
- BB. Stamens exceeding galea; each lobe of lower lip a deep sac, 1.5 times deeper than long.....25. *O. floribundus*

TREATMENT OF SPECIES

1. *Orthocarpus campestris* Benth., Pl. Hartw., 329, 1839.

Gray, Syn. Fl. 2:302, 1878; 2:302, 1886. Jepson, Man. Calif., 942, 1925. *Orthocarpus columbinus* Jones, Contr. Western Bot. 8:37, 1898.

Stems simple, few- or many-branched, 1-2.5 dm. high, branches slender, the lower very long; herbage glabrous below; leaves entire, linear-lanceolate, 1.5-4 cm. long; spike wide, compressed, 2-8 (-10) cm. long; bracts same as the leaves, glabrous, ciliate-margined, or puberulent, 1-2.5 cm. long; calyx strongly hirsute, 2-cleft, each division in turn 2-cleft with lanceolate teeth; corolla white or yellow, with occasional purple markings on sides of galea, 15-25 mm. long, lower lip very ample, abruptly widening from the tube, puberulent, ca. 5 mm. long, 3.5 mm. deep, teeth white, oblong, erect, 1.5-2 mm. long, lower lip villous within at base of teeth; galea straight, narrow, subulate, puberulent, surpassing lower lip 1 mm., 5-6 mm. long; anthers 2-celled, upper cell 4 or 5 times the length of lower one, glabrous, filaments glabrous,

free *ca.* 4 mm.; pistil equaling or slightly exceeding galea, glabrous, stigma globose or somewhat two-lobed; capsule ovate, brown, shiny, 5-7 mm. long; seeds many, irregular, narrow, 0.75 mm. long, coat thin, close-fitting.

Distribution: valleys at middle altitudes, sometimes standing in water in marshy places; occasional from Lake County, Oregon, to Sacramento Valley, California; probably introduced into Santa Clara County. *Type locality*: Sacramento Valley. OREGON: Riley, Harney County, *Cooper in 1914* (WS); Button Springs, Lake County, *Leiberg 791* (G, WS, UC); Swan Lake, Klamath County, *Applegate 390* (Applegate Herbarium). CALIFORNIA: Modoc County, *Baker in 1893* (G, UC); Upper Sacramento, *Hartweg 1902* (probably type collection, G), *Stillman* (G); Goose Valley, Shasta County, *Eastwood 962* (G, CA); Prattville, *Jones in 1897*, (type collection for *O. columbinus*, Po, CA), *Coombes in 1906* (G, CA); North Sacramento, *Ramaley 11240* (UC); Butte County (?), *Summers in 1886* (UC); Frenchman's Dam, Santa Clara County, *Stinchfield 482* (St).

This well defined species seems to be a connecting link between the subgenus *Euorthocarpus* and the subgenus *Triphysaria* as regards the anther character which distinguishes these groups. In this species the lower cell of the anther is very small, often apparently infertile, which seems to point out that the one-celled anther group arose from the two-celled through the loss of the lower cell. *Orthocarpus columbinus* Jones, is genuine *campestris*.

2. *Orthocarpus lithospermoides* Benth., Scroph. Ind., 13, 1835.

Stems stout, erect, simple or few-branched above, 1.5-5 (-7) dm. high; herbaceous parts pilose-pubescent; leaves 2-8 cm. long, entire below, lanceolate or 3-5-7 parted above into linear divisions; spike heavy, condensed; bracts same as upper leaves, 10-25 mm. long, 5-10 parted with divergent, attenuate lobes, 5-8 mm. wide at base, about equaling tube of corolla; calyx 8-14 mm. long, cleft half way with 4 subequal attenuate lobes, strongly hirsute; corolla clear yellow or white turning pinkish with age, usually 2 (or 1) purple spots at base of lower lip, 15-25 mm. long, pubescent or puberulus, tube extending be-

yond calyx, lower lip widely expanding from throat, each sac globose or conical, 4-6 mm. deep, 4-6 mm. long, inner margin floccose, teeth oblong, 2-3 mm. long; galea straight, subulate, exceeding lower lip 0.5-3 mm.; stamens enclosed in galea, filaments glabrous or more rarely pubescent, anthers pubescent, 1.5-2 mm. long; pistil included in galea, glabrous, often flattened toward the small somewhat 2-lobed stigma; capsule ovate, brown, 5-6 mm. long; seeds many, in thin loose-fitting reticulate coats.

- A. Corolla clear yellow. Coastal Valleys and foothills from Santa Clara County, California, to southern Oregon2a. var. *typicus*
 AA. Corolla white turning pinkish with age. Valleys, Napa County, Lake County, to Butte County, California2b. var. *bicolor*

2a. *Orthocarpus lithospermoides* var. *typicus*, nom. nov.

Orthocarpus lithospermoides Benth., l. c. Gray, Syn. Fl. 2:302, 1878; 2:302, 453, 1886. Jepson, Man. Calif., 942, 1925.

Distribution: coastal valleys and foothills from southern Oregon to Santa Clara County, California. *Type locality*: California, probably near San Francisco. OREGON: Glendale, *Howell 1247* (in part, WS), in 1887 (UC), *Jones in 1902* (Po); Grant's Pass, *Howell 239* (G). CALIFORNIA: Douglas (probably type collection, G); Carlotta, Humboldt County, *Hawver in 1915* (CA); Dyerville, *Jones in 1924* (Po); Laytonville, *Jones in 1924* (Po); Ukiah, *Jones in 1924* (Po); Lakeport, *Munz 9877* (Po); Napa, *Heller 5602* (G, St); Fairfield, *Heller & Brown 5370* (RM, St, Po, G); Fairfax Meadows, Marin County, *Eastwood in 1907* (G, CA); N.E. of Mt. Diablo, *Brewer 1132* (G); Crystal Springs, *Abrams 2440* (Po, RM, St, G); Stanford University, *Baker 662* (Po, WS, G, CA, UC); Saratoga, *Pendleton 704* (Po); Santa Cruz, *Jones in 1881* (Po); Gilroy, *Ferris in 1922* (St).

This plant might be confused with the large form of *O. lacerus* found in Butte County, but the ranges of the two species do not approach each other. The material of variety

typicus shows little variation throughout the range. However, this plant apparently hybridizes readily and material of this kind is not uncommon in herbaria. Experimental work is necessary here to determine the possibilities of hybridization with other species but it apparently crosses with *O. densiflorus* var. *typicus* as found at Stanford University, *Baker 663* (Po, G); Clear Lake, *Abrams 2419* (St); Potter Valley, Mendocino County, *Purpus in 1889* (UC); Tiburon, Marin County, *Brandegee in 1909* (in part, UC). Also it apparently hybridizes with *O. castillejoides* var. *typicus* as, near Napa, *Heller 5601* (G, St); Napa Valley, *Greene 1961* (G) approaches the hybrid. Another plant from Napa County, *Sonne in 1888* (in part, UC), I judge is a cross with *O. purpurascens* var. *typicus*. Plants from the Rogue River watershed, Oregon, have been found which approach *O. hispidus*, Glendale, *Howell 1247* (in part, WS), *Henderson 1408* (G); Cow Creek Mountains, *Cusick 4854* (WS).

2b. ***Orthocarpus lithospermoides* var. *bicolor*** (Heller) Jepson, Man. Calif., 942, 1925.

Orthocarpus bicolor Heller, *Muhlenbergia* 1:59, 1904.
Orthocarpus rubicundulus Jepson, Man. Calif., 943, 1925.

Distribution: valleys from southern Siskiyou County, through Butte County, to Lake and Napa Counties, California. *Type locality*: Clear Creek, Butte County. "California", *Fremont 437, 479* (G), *Hartweg* (G); Hilt, Siskiyou County, *Smith in 1915* (CA); Goose Valley, Shasta County, *Eastwood 962* (in part, CA); Clear Creek, Butte County, *Heller & Brown 5519* (type collection, Po, St, RM, G), *Heller in 1914* (St); 5 mi. N. W. of Hamilton, Glenn County, *Heller 11346* (G, CA, St, UC); Leesville, *Heller 13116* (G, CA, St); Indian Valley, N. Lake County, *Jepson 9001* (type of *O. rubicundulus*, Jepson Herbarium); Hough's Springs, Lake County, *Heller 12380* (G, St, CA); Knoxville Ridge, *Jepson 9042* (Po, UC); Knoxville, *Baker 2965* (Po, RM, G, CA, UC); Calistoga, *Eastwood in 1900* (RM); near Petrified Forest, *Eastwood 4589* (CA).

This plant was first described by Bentham, Pl. Hartw., 329, 1839, from a specimen collected in the Sacramento Valley. He

called it a form of *O. lithospermoides*. In the Sacramento Valley the plants are exceedingly robust and the flowers are usually larger than in var. *typicus*. It was this material that Heller named *O. bicolor*. In Lake and Napa counties this variety is smaller flowered and the spikes are narrower. However all gradations are found in the herbaria so I can not agree with Jepson that this is a distinct species, *O. rubicundulus*.

3. *Orthocarpus lacerus* Benth., Pl. Hartw., 329, 1839.

Gray, Syn. Fl. 2:302, 1878; 2:302, 1886. Jepson, Man. Calif., 942, 1925. *Orthocarpus brownii* Eastw., Bull. Torr. Club 32:210, 1905.

Stems rather weak, erect, simple or with ascending branches, 1-3 dm. high, purplish, hirsute-pubescent; leaves linear, 1-5 cm. long, entire or pinnately parted into 3-7 linear divisions, pubescent with occasional glands; spike wider and less compact than in *O. hispidus*, 2-15 cm. long, upper flowers divergent and extending beyond tip of spike; bracts 10-20 mm. long, palmately 3-5-7 cleft into subequal linear lobes; calyx cleft almost halfway with 4 subequal, widely lanceolate lobes, 7-10 mm. long on the flower, as much as 12 mm. long on the fruit, half as long as corolla, bracts and calyx pilose, scarcely glandular; corolla deep yellow, usually with two purple dots at base of lower lip, soft-pubescent, 10-18 mm. long, tube twice as long as lower lip and gradually expanding into it; lower lip inflated, 4-5 mm. long, ca. 4 mm. deep, teeth narrowly oblong, 1 mm. long; galea subulate, acute, 4-6 mm. long, 3-4 mm. wide, pubescent without and within including inner margins, straight; stamens glabrous, anthers 1.5 mm. long, filaments free 4 mm.; pistil glabrous, longer than in *O. hispidus*, ca. equaling tip of galea; capsule oblong or elliptical, light brown, 5-7 mm. long; seeds many, in a loose-fitting reticulate coat.

Distribution: common on the western slope of the Sierra Nevada Mountains from 3000-7000 feet elevation, southern Oregon to Fresno County, California. *Type locality*: Sacramento Valley. OREGON: Keno, Klamath River, *Applegate 391* (G). CALIFORNIA: *Hartweg 1901* (probably type collection, G); Yreka, *Butler 1407* (Po, RM, UC, St), *Greene*

828 (G); Mt. Eddy, *Heller 13260* (G, CA, St); Goose Valley, Shasta County, *Eastwood 752* (G, CA); Pitt River, *Smith 307* (G, CA), *220* (CA); Redding, *Heller 7909* (G, UC, St); South Yollo Bolley, *Jepson 1897* (UC); Red Clover Valley, Plumas County, *Heller & Kennedy 8752* (G, UC, St); Prattville, *Heller & Kennedy 8797* (G, St), *Coombes in 1902* (G, UC); Berry Canyon near Clear Creek, *Heller & Brown 5459* (type collection for *O. brownii*, Po, RM, St, G); Chico, *Bidwell in 1878* (G); Nevada City, *Eastwood 587* (G, CA); Emigrant Gap, *Jones in 1882* (Po); Auburn, *Ames in 1886* (G); Cisco, *Heller 13295* (G, St), *Bolander & Kellogg* (G); Gregory, *Jones 243* (G); Yosemite, *Hall & Babcock 3324* (Po, RM, UC, St); North Fork of Kings River, *Hall & Chandler 149a* (UC).

The three species *lacerus*, *hispidus* and *lithospermoides* are closely related. *Orthocarpus lacerus* is very similar in appearance to *O. lithospermoides* in its larger forms but it is more often confused with *O. hispidus* in the smaller forms. Plants of *lacerus* when grown in a dry or barren situation will produce flowers that would be small for *hispidus*. Intermediates between the latter two species occur where their distributions overlap. The collection from Soda Springs, Nevada County, *Jones 2599* (Po), is one of these. Since the size of the corolla varies in the field the most reliable character to distinguish this species from *hispidus* is the pubescence found within the galea near the margins.

4. *Orthocarpus hispidus* Benth., Scroph. Ind., 13, 1835.

Gray, *Syn. Fl.* 2:302, 1878; 2:302 and 453, 1886. Jepson, *Man. Calif.*, 942, 1925. *Orthocarpus hispidus* var. *tenuis* Macb. and Pays., *Contr. Gray Herb.*, n. ser., 49:70, 1917. *Orthocarpus tenuis* Heller, *Muhl.* 1:45, 1904. *Orthocarpus falcatus* Eastw., *Bull. Torr. Club* 32:212, 1905. *Orthocarpus rarior* Suksdorf, *Allg. Bot. Zeit.* 12:27, 1906. *Triphysaria hispida* Rydb., *Bull. Torr. Club* 40:484, 1913.

Stems slender, erect, simple or with few erect branches, hirsute-pubescent, 1-4 dm. high; leaves 1-4 cm. long, pubescent, lower linear, entire, upper lanceolate, 3-5 cleft; spike slender, compact, 3-15 (-20) cm. long, herbage of inflores-

cence hirsute to pilose and sometimes slightly glandular, corollas usually not extending above tip of spike; bracts 10-25 mm. long, ovate, 3-7 cleft into attenuate lobes; calyx 8-10 mm. long, cleft half way before and behind, each lobe cleft into two attenuate teeth; corolla white or yellow, 12-20 mm. long, pubescent, exceeding bract, (upper flowers exerted from spike) lower lip small, 3-4 mm. long, *ca.* 2 mm. deep, teeth oblong, small; galea straight or curved, narrow, 4-5 mm. long, 2-3 mm. wide at base, lanceolate, margins on ventral side glabrous, exceeding lower lip 1-2 mm.; stamens enclosed in galea, anthers pubescent, 1-1.5 mm. long, filaments naked, free 3-4 mm.; pistil included in galea, extending as far as lower lip, glabrous; capsule oblong, brown, 5-8 mm. long; seeds numerous, small, brown, in a loose reticulate coat.

Distribution: common in valleys to 6000 feet, northern Idaho to northwestern Nevada; Alaska to southern Oregon; eastern California south to Lake Tahoe; very rare in southern California. *Type locality*: banks of the Columbia. IDAHO: Camas Prairie, Blaine County, *Macbride & Payson 2911, 3833* (G, RM, CA, UC, Po, St); House Creek, Owyhee County, *Nelson & Macbride 1770* (RM, G); Big Willow, *Macbride 121* (G, RM, WS). NEVADA: Humboldt Reserve, Elko County, *Kennedy 4249* (G); Carson City, *Ander-son in 1865* (G); Washoe Lake, *Jones in 1897* (Po, RM); King's Canyon, *Baker 1128* (Po, RM, CA, UC, G). ALASKA: Skagway, *Eastwood 752a* (G, CA). VANCOUVER ISLAND, B. C.: Victoria, *Macoun 722* (G). WASHINGTON: Wenatchie region, *Brandege 1023* (G); Sprague, *Sandberg & Leiber 153* (G, WS, UC); Spokane, *Piper in 1896* (G, WS); Falcon Valley, *Suksdorf 2779* (type collection for *O. rarior*, WS, G, UC, St); Silver Lake, *Henderson 2265* (WS). OREGON: Portland, *Sheldon 510829* (Po, G, WS, St); Big Meadows, Des Chutes River, *Leiber 507* (G, UC, Po); Klamath Lake, *Peck 9498* (G). CALIFORNIA: Yreka, *Greene 852* (G); Quartz Valley, *Butler 1461* (Po, St, UC); Goose Valley, *Eastwood 957* (G, CA); Lassen's Peak, *Jones in 1897* (Po); Brush Creek, Butte County, *Conger in 1907* (UC); Chico, *Heller 11509* (G, UC, CA, St); Donner Lake, *Heller 6907* (type collection for *O. tenuis*, G, UC, RM, St, Po); Greene Valley, San Bernardino

County, *Shaw & Illingsworth 65* (St); Palomar Mt., *Parish 4471* (G, UC, St), 4475 (type for *O. falcatus*, CA).

This species varies in flower color from white to a deep yellow. In general white seems to be the early season flower color while yellow is the late season shade. Plants that are grazed or otherwise injured in the spring are retarded so that they may produce yellow flowers a month or two after the uninjured plants of the field have produced white blooms. A top injury is often responsible for branching which occasionally occurs in this species. The material for *O. hispidus* var. *tenuis* Macb. & Pays., was of this nature. *O. rarior* Suksdorf, and *O. tenuis* Heller, are genuine *hispidus*. The Parish collection from Palomar Mt., southern California, which was described as *O. falcatus* Eastwood, shows only the minor variations one would expect in plants 500 miles out of their range. The falcate galea can be duplicated in the plants of the Tahoe region and elsewhere.

5. *Orthocarpus lasiorhynchus* Gray, Proc. Am. Acad. 12:82, 1876.

Gray, Syn. Fl. 2:302, 1878; 2:302, 1886. Jepson, Man. Calif., 942, 1925.

Stems erect, simple or branching from near the base, slender, 1-3 (-4) dm. high, hirsute, often purplish; leaves 1-3 cm. long; entire or seldom with 2 or 4 lateral lobes, linear or linear-lanceolate, pubescent, loose spike 2-15 cm. long; bracts 6-12 mm. long; 3-5 parted with linear divisions, soft-hirsute, uppermost tipped with lemon-yellow and almost bearded, calyx 6-12 mm. long; equaling bract, more hispid, cleft into two lobes each with two attenuate teeth, corolla yellow, 12-22 mm. long, twice as long as calyx and bract, tube slender, glabrate or pilose-pubescent, abruptly expanding into lower lip which is glabrous or glabrate, inflated, 4-5 mm. deep, 6-7 mm. long, teeth bearded, 2 mm. long, erect but not exceeding the protruding lower lip; galea straight, narrow, bearded, exceeding lower lip 2 mm.; capsule 6-9 mm. long, elliptical, light brown; seeds many, in loose-fitting alveolar coats.

Distribution: montane, 4000-6500 feet; southern California from the eastern half of the San Bernardino Mountains to the

Cuyamaca Mountains, San Diego County; southwestern Arizona. *Type locality*: Mohave River, north slope of the San Bernardino Mountains. Southern California, *Parry & Lemmon 318* (G); Mohave River, *Palmer 313* (type, G); Little Bear Valley, San Bernardino Mountains, *Parish 482* (G, UC), *10950* (UC, St); Fish Camp, San Bernardino Mountains, *Johnston 2916* (Po, RM); Green Valley, San Bernardino Mountains, *Chandler in 1897* (UC); Big Bear Valley, San Bernardino Mountains, *Parish 482* (G), *10931*, *3766* (G, UC, St), *3048* (UC), *Wilder 760* (Po), *Abrams 2107* (Po, St), *Harwood 4376* (Po, RM), *Edwards in 1916* (Po), *Pierce in 1922* (Po); San Bernardino Mountains, *Hall 1001* (RM), *1302* (UC), *Wright 246* (G); San Jacinto Mountains, *Hall 649* (UC, St), *Parish 482* (St); Cuyamaca Valley, *Greene 408* (G). ARIZONA: Valley of the Hassayampa, *Palmer 313* (UC).

The center of distribution is in the eastern half of the San Bernardino Mountains. It has rarely been collected at other stations. The species is distinct from the others of its section and is a constant one in the field.

6. *Orthocarpus castillejoides* Benth., Scroph. Ind., 13, 1835.

Annual or occasionally biennial herbs with simple erect stems or corymbosely branched with many ascending or decumbent branches often 0.5-1 m. long, plant usually 1-3.5 dm. high, stems puberulent to hirsute; leaves lanceolate to oblong (or ovate), acute or obtuse, 1-5 cm. long, pinnately toothed with 1 or 2 pairs of rather short lanceolate lobes above, entire below, scabridus-puberulent; spike often subcapitate, terete, or extended becoming more lax below, 3-8 (-12) cm. long; bracts green or upper ones tipped with yellow or purple, oblong to ovate in outline, 14-22 mm. long, palmately cleft into 2-8 lateral lobes usually obtuse or truncate; calyx 12-20 mm. long, deeply parted in back, cleft in front, each lobe bearing a pair of linear attenuate or rounded teeth, villous, tipped with color as the bracts; corolla yellow with purple markings, 14-25 mm. long, exceeding bract and calyx, tube sparingly hirsute, gradually expanding into lower lip; lower lip shallowly, or rather deeply, 3-saccate, 4-6 mm. long

not including erect obtuse purple (sometimes yellow) teeth, 1-3 mm. long; galea straight or slightly curved, exceeding lower lip 2-4 mm., margins membranous, tip obtuse; stamens inserted in the galea, filaments glabrous, anther-cells sparsely ciliate; pistil glabrous, stigma exserted from tip of galea, capitate or slightly 2-lobed; capsule brown, elliptical, 8-12 mm. long; seeds many, large, yellowish, enclosed in loose reticulate coats.

- A. Bracts tipped with white or yellow or pinkish; lower lip of corolla yellow with purple dots.
 - B. Leaves usually widely lanceolate; spike terete.....6a. var. *typicus*
 - BB. Leaves oval or elliptical, broader and shorter than var. *typicus*; spike compressed to a wide subcapitate inflorescence6b. var. *insalutatus*
- AA. Bracts tipped with purple; lower lip of corolla purple with outer third yellowish. Humboldt County6c. var. *humboldtiensis*

6a. *Orthocarpus castillejoides* var. *typicus*, nom. nov.

Orthocarpus castillejoides Benth., l. c. Gray, Syn. Fl. 2:300, 1878; 2:300, 1886. Jepson, Man. Calif., 943, 1925. *Orthocarpus maculatus* Eastw., Bull. Torr. Club, 32:210, 1905. *Orthocarpus longispicatus* Elmer, Coult. Bot. Gaz. 41:317, 1906.

Distribution: saline soils along the coast from Vancouver Island, B. C., to Monterey County, California. *Type locality:* California, probably San Francisco or Monterey. VANCOUVER ISLAND: Alberni, *Henry in 1916* (CA). WASHINGTON: Everett, *Piper 4987* (WS, G); Copalis, *Conard 385* (WS, G). OREGON: Astoria, *Cooper* (G); Yaquima Bay, *Lawrence 1822* (St); Bandon, *Peck 9001* (G). CALIFORNIA: *Douglas* (probably type collection, G); Pebble Beach, Del Norte County, *Parks 8261* (UC); Humboldt County, *Holman in 1925* (UC); Fort Bragg, *Eastwood in 1902* (type for *O. maculatus*, CA); Duncan's Mills, *Jones in 1882* (Po); Point Reyes P. O., *Elmer 4938* (type collection for *O. longispicatus*, Po, CA, St); Vallejo, *Greene 165* (G); San Francisco, *Kellogg in 1866* (G, UC); Moss Beach, *Brandege in 1905* (G, RM, UC); Monterey, *Hall 10068* (G, UC).

This species more closely resembles the genus *Castilleja* than any other *Orthocarpus* here treated. It includes the rankest growing representatives of the genus and among the marsh plants especially, many times it has been mistaken for a *Castilleja* on account of the spreading habit, truncate bracts and inconspicuous flowers. Also the plants actually growing in water occasionally produce a biennial root which confuses these with members of the genus *Castilleja*. This species is the most difficult within the genus for the taxonomist to handle for it is extremely variable. Each colony seems to produce a unique form of its own. Many of these are certainly ecological for the species grows in various saline soils along the coast and some of the plants actually grow in the salt water. In herbaria the most common form is the plant with decumbent branches and with a conspicuous lower lip on the flowers. In this treatment I recognize two varieties in addition to *typicus* because of their geographic isolation and the constancy and the importance of their characters. A large number of minor variations exist in the species. *Orthocarpus maculatus* Eastwood, is a synonym, the type being one of the commoner forms of this variety. *Orthocarpus longispicatus* Elmer, seems to me to be an ecological form and since Elmer's one collection is all I have seen of this I do not give it a higher rank though it looks quite different from the rest. Specimens from Noyo, Mendocino County, *Bolander 6538* (UC), and the salt marshes, San Francisco, *Kellogg & Harford 705* (G), are undoubtedly hybrids between var. *typicus* and *O. purpurascens* var. *latifolius*. A cross between this variety and *O. purpurascens* var. *typicus* was found at Carmel Bay, *Elmer 5084* (St). (See discussion under *O. lithospermoides* var. *typicus*.) Some of the variations make this plant easily confused with *O. densiflorus*. It has been introduced into New Mexico, Santa Fe, *Dudley in 1908* (St).

6b. *Orthocarpus castillejoides* var. *insalutatus* Jepson, Man. Calif., 944, 1925.

Leaves oval or elliptical, broader and shorter than var. *typicus*, 10-25 mm. long, 5-12 mm. wide; spike compressed to a wide subcapitate inflorescence. Otherwise as var. *typicus*.

Distribution: Monterey County. *Type locality*: Pacific Grove. CALIFORNIA: *Andrews* (G), Monterey, *Parry in 1883* (G), *Brewer 663* (G), *Patterson & Wilts in 1907* (St); between Point Pinos and Pacific Grove, *Heller 6745* (Po, RM, G, UC, St).

6c. *Orthocarpus castillejoides* var. *humboldtiensis*, var. nov.

Bracts and calyx purple-tipped, each lobe of bract truncate; corolla purplish, throat purple, lower lip with outer third yellowish, teeth very large, 3 mm. long, purple. Otherwise as var. *typicus*.

Type: from saline flats, Eureka, Humboldt County, California, June 20, 1925, *P. A. Munz 9890* (Pomona College Herbarium No. 71753).

Distribution: salt marshes of Humboldt Bay. Humboldt Bay, *Abrams 8249* (RM, Po, St), 7087 (St), *Kellogg & Harford 701* (G, CA), *Rattan* (St, G), *Dudley in 1899* (St); Samoa, *Tracy 867* (UC), *Dudley in 1899* (St).

7. *Orthocarpus densiflorus* Benth., Scroph. Ind., 13, 1835.

Stems erect, branching, 1.5-3.5 dm. high, puberulent, yellowish, slender; leaves sessile, linear or linear-lanceolate, attenuate, usually entire below, above with two linear lobes, puberulent or finely pubescent, 2-8 cm. long; spike dense, 2-10 cm. long, average 4 cm. long, purplish; bracts 8-20 mm. long, usually 3-lobed, occasionally 4- or 5-lobed, upper bracts purplish-tipped (white-tipped in var. *obispoensis*), pubescent; calyx 10-25 mm. long, pubescent as bracts, cleft a third to half way with 4 subregular linear lobes, tips expanded and pink (creamy-white in var. *obispoensis*), *ca.* equaling throat of corolla; corolla 10-25 mm. long, yellow or purplish, usually with 3 prominent purple spots on the anterior part of the lower lip, pubescent, lower lip 2-4 mm. long, teeth 1.5-2.5 mm. long, *ca.* equaling galea, purple (white in var. *obispoensis*); galea 6-7 mm. long, subulate, puberulent without; stamens glabrous, anthers 2 mm. long, filaments free 5-8 mm.; pistil glabrous, stigma exerted from tip of galea, globose or 2-

lobed; capsule ovate, 7-10 mm. long; seeds black, *ca.* 0.5 mm. long, in a loose-fitting cone-shaped reticulate coat.

A. Spike purplish, galea purple.

B. Bracts equaling corolla; corollas not exerted in the spike, lower lip not as deep as long, teeth 1-2.5 mm. long.....7a. var. *typicus*

BB. Bracts equaling throat of corolla; corollas exerted from the spike, lower lip as deep as or deeper than long, teeth minute.....7b. var. *gracilis*

AA. Spike whitish, galea white.....7c. var. *obispoensis*

7a. *Orthocarpus densiflorus* var. *typicus*, nom. nov.

Orthocarpus densiflorus Benth., l. c. Gray, Syn. Fl. 2:300, 1878; 2:300, 1886. Jepson, Man. Calif., 943, 1925. *Orthocarpus noctuinus* Eastw., Bull. Torr. Club, 32:211, 1905. ?*Castilleja ambigua* H. & A., Bot. Beech., 154, 1833.

Spike dense, purplish; bracts equaling corollas; corollas not exerted from spike, lower lip longer than deep.

Distribution: a common species extending along the California coast from Mendocino County to Los Angeles County. Rare in the Sierra Nevada foothills. *Type locality*: probably San Francisco or Monterey, possibly Santa Barbara. CALIFORNIA: Douglas (probably type collection, G); Willets, Jones in 1924 (Po); Healdsburg, Heller & Brown 5236 (Po, G, RM, St); Santa Rosa, Heller & Brown 5307 (Po, G, RM, St); Lagunitas, Eastwood 43 (G, CA); Berkeley, Walker 175 (Po, UC); Livermore, Bioletti in 1892 (RM); Stoney Creek, Amador County, Hansen 1675 (St); French Flat, Tuolumne County, Ferris 1507 (St, CA); San Francisco, Heller 6596 (Po, G, RM, UC, St); Stanford University, Baker 621 (G, Po, UC), Abrams 2348 (RM, Po, G, St), 1551 (Po, St); Del Monte, Heller in 1903 (G); 15 mi. N. E. of Morro, Munz & Keck 10198 (Po); Morro Creek, Munz 9202 (Po); Bear Creek, Tulare County, Purpus 1719 (UC); Santa Monica, Crawford & Hiatt in 1916 (Po); Los Angeles, Greata in 1899 (St).

This species is closely related to every other in the section with the possible exception of *O. laciniatus*. Occasional plants approach *attenuatus* and *castillejoides* and are confusing inter-

mediates. A distinct form from Inverness, Marin County, *Eastwood in 1901* (type for *O. noctuinus*, CA), seems to me to have *lithospermoides* qualities which suggest hybrid origin. Hybrids undoubtedly do occur between these two species (see discussion under *O. lithospermoides* var. *typicus*). Gray, in *Bot. Calif.* 1:576, 1876, says, “. . . the var. *latifolius*, Benth., with few or no lobes to the cauline leaves, is the commoner form.” I have not found Bentham's original reference.

7b. *Orthocarpus densiflorus* var. *gracilis* (Benth.), comb. nov.

Orthocarpus gracilis Benth., *Scroph. Ind.*, 12, 1835. Gray, *Syn. Fl.* 2:302, 1878; 2:302, 1886. Jepson, *Man. Calif.*, 943, 1925. *Orthocarpus parishii* Gray, *Proc. Am. Acad.* 17:229, 1882. Gray, *Syn. Fl.* 2:453, 1886.

Bracts equaling throat; corollas exerted from spike, lower lip conical or rounded, as deep as or deeper than long.

Distribution: Monterey and Santa Barbara counties, near the coast, appearing again in lower Orange County and San Diego County where it is plentiful at moderate altitudes as well as along the coast; it extends south into Lower California. *Type locality*: probably Monterey. CALIFORNIA: *Douglas* (probably type collection, G); Santa Lucia Mountains, Monterey County, *Eastwood in 1897* (UC, G), *in 1898* (G), *Brandegee in 1909* (UC), *Ferris 1803, 1852, 3665* (St); Jolon, *Eastwood 4086* (G); Paso Robles, *Barber in 1899* (UC); 10 mi. E. of Lompoc, *Munz & Keck 10309* (Po); Claremont, *Shaw 454* (St); Capistrano, *Abrams 3266* (G, Po, UC, St); Henshaw Dam, San Diego County, *Munz 10341* (Po), *Jaeger in 1926* (Po); Cuyamaca Mountains, *Parish 482* (G); Cuyamaca Lake, *Munz 9781* (Po); Julian, *Keck, Hill, McCully 128* (Po); Otay Creek, *Peirson 3372* (Po); LaJolla, *Clements 127* (G, UC); San Diego, *Brandegee 821* (WS, Po, G, CA, UC); Ensenada, Lower California, *Jones 3722a* (Po, G, RM).

The material from the Santa Lucia Mountains, Monterey County, with the white deeply saccate lower lip on the small corollas, quite divergent from the spike and borne on slender multi-branched plants, looks distinct from var. *typicus*. It was

this material that Bentham named *O. gracilis*. However the material a little further south more and more resembles var. *typicus*. The most persistent character for *gracilis* is the white deeply saccate lower lip but in San Luis Obispo and Santa Barbara counties fields are found containing plants with all gradations in the size of the lower lip and the color varies from white to pink regardless of this character. The plants of this large area do not suggest hybrids. Rather they seem to indicate the point of origin for the more distinct *gracilis* of Monterey County. The same situation occurs in southern California. The material from the Cuyamaca Mountains, which Gray named *O. parishii*, has been found, both by field and herbarium study, to be identical with that from the Santa Lucia Mountains. Part of the southern material develops larger corollas but no specific or varietal differences have been found and none were pointed out by Gray. Near the coast of San Diego County the plants approach var. *typicus* until they are indistinguishable from it. Because of this evident origin and the blending of the groups at two different points of their range I reduce *gracilis* to varietal rank under *densiflorus*. This plant unquestionably hybridizes with the varieties of *O. purpurascens* as at San Diego, *Brandegee in 1906* (UC).

7c. *Orthocarpus densiflorus* var. *obispoensis*, var. nov.

Spike white, corollas somewhat exserted from spike; corollas creamy-white with few purple dots, lower lip deeply saccate. Otherwise as var. *typicus*.

Type: from grassy slope, 1 mile north of Morro, San Luis Obispo County, California, April 8, 1926, *P. A. Munz and D. D. Keck 10242* (Pomona College Herbarium No. 89481).

Distribution: coastal San Luis Obispo County. Pismo Beach, *Munz & Keck 10244* (Po); San Luis Obispo, *Jones 3243* (Po, CA, RM), *Brewer 476* (G, UC), *Brandegee* (UC).

In the field the creamy-white spikes recall *O. attenuatus* but they are much too wide and the deeply saccate lower lip is like that in var. *gracilis* which variety this plant closely resembles. Variety *obispoensis* is well isolated both as to characters and distribution. I have seen no intermediates although they are likely to occur.

8. *Orthocarpus purpurascens* Benth., Scroph. Ind. 13, 1835.

Stems simple to diffusely branched from near the base, 1-4 dm. high; herbage villous-pubescent; leaves sessile, 10-50 mm. long, few- to many-parted into filiform or linear divisions; spike dense, 2-20 cm. long; bracts 10-20 mm. long, dilated at base, 10-15 mm. across the top, 5 or 7 linear divisions, the middle one usually 3-lobed, *ca.* equaling the corolla, green at base with a pubescence of long jointed hairs, pale pink to purple above, tips of lobes often swollen and covered with a short pubescence; calyx equaling the bract, the four linear lobes equal, pubescence and markings like the bracts; corolla crimson or purplish, 12-30 mm. long; lower lip purple, crimson, pink, yellow or white, most commonly purple tipped with yellow, 3-7 mm. long, 3-5 mm. across, shallow or rather deeply saccate, teeth minute, *ca.* 1 mm. long, oval; galea crimson or purple, exceeding lower lip by 2-3 mm., ending in an abrupt hook, densely pubescent on the ridge, ending in a tuft of soft cellular hairs; stamens enclosed in galea, anther-cells sparingly puberulent, 1.5-2 mm. long, filaments densely pubescent to glabrous, 5-10 mm. long; pistil equaling corolla, stigma globose, 1 mm. wide, held in the curved tip of the galea, style glabrous; capsule ovate, 10-15 mm. long; seeds ovate to elliptical, less than 1 mm. long, smooth, in a loose-fitting alveolar coat.

- A. Lower lip of corolla purple, sometimes tipped with yellow.
- B. Floral bracts green below becoming deep crimson above with the tips of the lobes pinkish. Restricted to the coast regions from Monterey County to Lower California.
- C. Floral bracts palmately cleft into filiform or linear lobes 1 mm. or less wide.....8a. *var. typicus*
- CC. Floral bracts palmately cleft into linear-spatulate lobes 1-2 mm. wide, tipped with pale lavender and giving the appearance of alternating light and dark bands along the spike; stems many, ascending from the base.....8b. *var. latifolius*
- BB. Floral bracts green below becoming pale or deep purple above with the tips of the lobes purplish pink.

- C. Lower lip deep purple with outer third a bright orange-yellow; whole inflorescence conspicuously red-purple. Western Mohave Desert. .8c. var. *venustus*
- CC. Lower lip purple with outer fifth a dull white. Dry interior valleys, Sacramento Valley south to the Tehachapi Mountains; Riverside County to northern Lower California, east to Arizona.8d. var. *palmeri*
- AA. Lower lip of corolla yellow or white, never purple. Santa Barbara south to Orange and San Bernardino counties.8e. var. *pallidus*

8a. *Orthocarpus purpurascens* var. *typicus*, nom. nov.

Orthocarpus purpurascens Benth., l. c. Gray, Syn. Fl. 2:300, 1878; 2:300, 1886. Jepson, Man. Calif., 944, 1925 (in part).

Bracts green, tipped with pink to crimson; lower lip of corolla purple, tipped (sometimes indistinctly) with a dull yellow or white.

Distribution: coastal valleys and foothills from Mendocino County to Lower California. *Type locality*: probably San Francisco or Monterey. CALIFORNIA: *Douglas* (probably type collection, G); Sulphur Banks, Lake County, *Bowman in 1901* (G), 266 (St); Santa Rosa, *Heller & Brown 5318* (Po, St, RM, G); Bodega Point, *Eastwood 4859*, in 1900, in 1901 (G); Benecia, *Jones 242a* (G), *Greene 114* (G); Bethany, *Baker 2784* (Po, G, CA, UC); San Francisco, *Thurber 474* (G); Stanford University, *Abrams 2382* (RM, St, G, Po), *Baker 620* (G, Po, UC); Seaside, *Heller 6565* (Po, UC, CA, St, RM, G); Del Monte, *Elmer 3572* (G, UC, St); King City, *Eastwood 4065* (G, CA); Morro, *Munz & Keck 10241* (Po); 30 mi. W. of Wasco, *Munz & Keck 10108* (Po); Lompoc, *Munz & Keck 10276* (Po); Santa Barbara, *Cooper in 1879* (G); Santa Cruz Island, *Miller in 1918*, *Swain in 1919* (CA); Saugus, *Munz & Keck 10006* (Po); Santa Monica Mountains, *Munz & Harwood 3943* (Po); Ballona Harbor, *Abrams 1181* (Po, St); Canada Salada, Orange County, *Peirson in 1923* (RM, St); Riverside, *Hall 2930* (Po, RM); San Diego, *Brandege in 1903*, in 1906 (Po, UC). LOWER CALIFORNIA: La Grulla, *Orcutt in 1886* (UC); Guadalupe Island, *Brandege in 1897* (UC).

This variety has been introduced into Washington: Seattle, *Piper* in 1891 (WS). Albino forms occur as in San Luis Obispo County, near Templeton, *Barber* A28 (UC). (For hybridization see discussion under *O. castillejoides*, *O. lithospermoides* and *O. densiflorus*.)

8b. *Orthocarpus purpurascens* var. *latifolius* Wats., Bot. King's Exp. 458, 1871.

Orthocarpus purpurascens var. *multicaulis* Jepson, Man. Calif., 944, 1925.

Floral bracts divided into wide and showy lobes which are paler than the corolla, arranged in rows so that the spike appears banded; stems with many branches from the base.

Distribution: occurs along the coast from Humboldt County to Monterey. *Type locality*: Noyo, Mendocino County. Noyo, Mendocino County, *Bolander* 6538 (one of type collections, G); Ft. Bragg, *Mathews* in 1914 (type of var. *multicaulis*, UC); Sonoma Valley, *Torrey* 362 (G); Pt. Reyes, *Davy* 6822 (UC); Oakland, *Torrey* 365 (G); Alameda, *Kellogg & Harford* 704 (G); Lake Merced, *Michener & Bioletti* in 1892 (Po), *Heller* in 1902 (G, St), *Brandege* in 1907 (UC); near Ocean View, San Francisco, *Heller* 8381 (G, CA, UC, St); Montara Point, *Copeland* 3298 (Po); Half Moon Bay, *Brandege* in 1905 (UC); Black Mountain, *Elmer* 4845 (Po, CA); Santa Cruz, *Gray* in 1872 (G), *Jones* in 1881 (Po); Monterey, *Brewer* 669 (G).

This apparently hybridizes with *O. castillejoides* var. *typicus*, salt marshes, San Francisco, *Kellogg & Harford* 705 (G).

8c. *Orthocarpus purpurascens* var. *venustus* (Heller), comb. nov.

Orthocarpus venustus Heller, *Muhlenbergia* 2:141, 1906. *Orthocarpus purpurascens* var. *ornatus* of Jepson, Man. Calif., 944, 1925.

A distinct variety in the field with its pronouncedly bright colors; corolla a deep velvet-red except for outer third of lower lip a deep orange-yellow, teeth yellow.

Distribution: this striking variety occurs on the western end of the Mohave Desert, California, growing in the open sandy stretches. It is rather uncommon. *Type locality*: Kramer, San Bernardino County. Inyokern, *Bailey in 1922* (Po); Mohave, *Eastwood in 1913* (CA); 10 mi. S. of Mohave, *Munz & Keck 10057* (Po); 5 mi. S. of Willow Springs, *Munz & Keck 10036* (Po); Kramer, *Heller 7677* (type collection, G, St, CA, UC), *Brandege in 1913* (Po, RM, G, UC), *in 1905* (UC); 10 mi. N. of Barstow, *Johnston 6502* (Po), *Shreve in 1915* (UC); Barstow, *Parish 9791* (UC, St), *9221* (St), *Jepson 5819* (UC); Daggett, *Hall 6153* (UC); Calico Mountains, *Jepson 5405* (UC); Rabbit Springs, *Parish 9755* (St); 15 mi. N. of Victorville, *Johnston 6504* (Po); Victorville, *Edwards in 1917* (Po); Deadman's Point, *Poe & Robinson in 1922* (Po), *Parish 10783* (UC); between Manzana and Gorman's, Antelope Valley, *Davy 2653* (UC).

8d. *Orthocarpus purpurascens* var. *palmeri* Gray, Syn. Fl. 2:300, 1878.

Gray, Syn. Fl. 2:300, 1886.

Upper portion of floral bracts purple making a showy spike; lower lip of corolla purple, the yellow or white tip bearing one or three purple spots.

Distribution: dry interior valleys from Sacramento Valley south, reaching the coast in Orange and San Diego counties and extending from northern Lower California, east into Arizona. *Type locality*: Wickenburg, Arizona. Anderson, Shasta County, *Smith 145* (CA); Red Bluff, *Cameron in 1896* (UC); 5 mi. N. W. of Hamilton, *Heller 11352* (G, CA, St); Chico, *Copeland 3035* (Po, UC, G); Clear Creek, *Brown 174* (RM, St); 6 mi. N. of Oroville, *Heller 10729* (G, UC, St); Auburn, *Ames in 1878*, *in 1891* (G); Ukiah, *Setchell in 1901* (UC); near Williams, Colusa County, *Ferris 520* (St); Nashville, El Dorado County, *Rixford in 1900* (RM); Peoria Pass, Tuolumne County, *Ferris 1598* (St); Pine Ridge, Fresno County, (5100 ft. elev.) *Hall & Chandler 296* (UC); Goshen, Tulare County, *Eastwood 3914* (G, CA); Springville, *Purpus 5066* (G); Corcoran, *Eastwood 3858* (G, CA); Sunset, *Heller 7735* (G, UC, St); Bakersfield, *Jones in 1924*

(Po); Castac Lake, *Dudley & Lamb 4476a* (Po, St); Tehachapi Mountains, *Munz 8946* (Po); Banning, *Jones in 1903* (Po); San Jacinto Mountains, *Hall in 1899* (RM), *2028* (UC); Laguna Canyon, *Munz 6599* (Po); near Bonsall, *Munz & Harwood 3875* (Po, RM); Cuyamaca Lake, *Munz 8941* (Po); Banner, *Jones in 1906* (Po); Campo, *Eastwood 9382* (Po, CA); Potrero Grade, *Munz 9469* (Po); Rincon, *Jaeger in 1925* (Po); La Jolla, *Clements 128, 129* (G); San Diego, *Spencer 1351* (G, CA, Po). LOWER CALIFORNIA: 15 mi. N. of Ensenada, *Canby 142* (Po); Ensenada, *Jones in 1882* (G), *3722* (Po, CA). ARIZONA: Congress Junction, *Jones in 1903* (Po); Hillside, *Jones in 1903* (Po); Wickenburg, *Palmer 634* (type collection, G, UC); Sierra Tucson, *Parish 189* (G, St); Ry, *Jones in 1890* (Po), Coronado Forest, *Eggleston 19820* (G); Santa Catalina Mountains, *Pringle in 1881* (G), *Thornber 477* (UC), Santa Rita Mountains, *Thornber 478* (UC); Miami, *Treacle in 1911* (Po).

The species *purpurascens* is so widespread that it varies considerably from one end of its range to the other. This variety is quite consistent in its showy purple spike found in the interior valleys. In the field it looks very different from the greener *typicus* of the coast. The line between these two varieties is rather artificial as we find them intermingling both in the Sacramento and upper San Joaquin Valleys as well as in southern California but I keep var. *palmeri* because it differentiates one large aggregate from the other. The form from the mountains of San Diego County is more bluish with large, deeply saccate corollas rather exserted from the spike but it can not be separated as a distinct variety. A specimen from Temescal Canyon, Riverside County, *Munz 5031* (Po), approaches var. *pallidus*.

8e. *Orthocarpus purpurascens* var. *pallidus*, var. nov.

Orthocarpus exsertus Heller, *Muhlenbergia* 1:109, 1904.

Lower lip of corolla yellow or white, never purple.

Type: Lincoln Park, near Pasadena, Los Angeles County, California, April 1902, *Grant 886* (Stanford University). There is a co-type at UC.

Distribution: Santa Barbara to the borders of Riverside and Orange counties; occasional at San Diego. CALIFORNIA: Santa Maria, *Munz 9286* (Po); 10 mi. E. of Lompoc, *Munz & Keck 10310* (Po); Santa Barbara, *Dexter in 1884* (G), *Baker in 1886* (G), *Eastwood 16* (G, UC), *Munz & Keck 10323* (Po); Santa Cruz Island, *Brandege in 1888* (UC); E. of Ventura, *Jones in 1926* (Po); Inglewood, *Abrams 3236* (G, St); Lincoln Park, near Pasadena, *Grant 6462* (Po, UC, St, RM, G); Claremont, *Robinson 65, 80*, (Po); Upland, *Munz 2106* (Po); San Bernardino Valley, *Parish 5883* (RM), *7073, 11142*, (UC); San Bernardino, *Cummings in 1896* (G); Anaheim, *Baker 4132* (Po); San Diego, *Spencer 1351* (Po); Chollas Valley, *Orcutt 1018* (G).

This variety is distinct in the center of its distribution but on the northwest and south it approaches var. *typicus* and on the east it approaches var. *palmeri*. Specimens from Palm Springs, *Hall 5761* (UC), appear to be forms of this variety. Heller's species, *exsertus*, is unsatisfactorily described for this material. The exserted corolla he emphasizes is not limited to the plants of this region. The white lower lip of the corolla is the outstanding character for the group. Heller's type collection has been retained as the type for this variety.

9. *Orthocarpus linearilobus* Benth., Pl. Hartw., 330, 1839.

Gray, Syn. Fl. 2:302, 1878; 2:302, 1886. Jepson, Man. Calif., 943, 1925. *Orthocarpus mariposanus* Congdon, Erythraea 7:188, 1899.

Erect, simple or branched above; stems 1.5-3.5 dm. high; herbage hirsute, more densely so above; leaves 2-5 cm. long, sessile, with 2 or 3 pairs of long linear lobes, green; spike dense, 3-8 cm. long; bracts 12-20 mm. long, nearly equaling the corolla, deeply cut by the slender lobes; calyx equaling bract, lobes slender much exceeding tube, bracts and calyx tipped with pale lilac-pink, the colored portions densely hirsute; corolla 15-25 mm. long, pubescent, tube white, lower lip yellow with two purple dots at base, galea lilac-pink, lower lip 3-saccate, sacs longer than deep, 4-6 mm. long, teeth small, erect, subulate, white, purple dot at base, galea exceeding lower lip by 2-3 mm., straight; anthers 2-celled, enclosed in

galea, glabrous, 1.5 mm. long; filaments naked; pistil glabrous, stigma exerted beyond tip of galea, globose or slightly 2-lobed, *ca.* 1 mm. in diameter; capsule ovate, 7-10 mm. long; seeds black, shiny, only half as large as the angled reticulate coat, 1 mm. long.

Distribution: Sierra Nevada foothills up to 5000 ft., Shasta County to Kern County, California. *Type locality*: in mountain pastures of the Sacramento region. CALIFORNIA: Sacramento Valley, *Hartweg 1903* (probably type collection, G); Anderson, Shasta County, *Smith in 1915* (CA); Auburn, *Sonne in 1891* (UC); New York Ravine, El Dorado County, *Brandegee in 1907* (UC, RM); Kelsey, *Jones in 1883* (Po); Clinton, Amador County, *Hansen 1651* (St); Indian Creek, Tuolumne County, *Ferris 1519* (St, CA); Mather, *Munz 7427* (Po, UC); Mariposa, *Congdon 75, in 1883* (G), *41* (St), *in 1893* (UC); Lewis, *Congdon in 1894* (UC), *in 1895* (G, UC), *in 1897* (St); Big Sandy Creek, Fresno County, *McDonald in 1916* (CA); Squaw Valley, *Jepson 2748* (UC); Kaweah River Basin, *Hopping 100, 287* (UC), *Woolsey in 1898* (UC); Milo, Tulare County, *Dudley in 1900* (St); Glenville, Kern County, *Weston 157* (CA).

A collection from Auburn, Placer County, *Ames in 1878* (G), appears to be this species approaching typical *O. densiflorus*.

10. ***Orthocarpus attenuatus*** Gray, *Pacif. Rail. Rep.* 4:121, 1856.

Gray, *Syn. Fl.* 2:299, 1878; 2:299, 1886. *Jepson, Man. Calif.*, 943, 1925.

A slender erect annual, usually unbranched or branching from the base, 1-3.5 dm. high; stems slender, pubescent; leaves sessile, linear-lanceolate, attenuate or with two lateral filiform lobes, pubescent, 2-6 cm. long; spike dense or more open below, 2-20 cm. long, green; bracts 15-20 mm. long, 3-lobed, each lobe two-thirds the total length of bract, stouter than calyx, white-tipped or with a purplish tinge in Tulare County material; calyx 20-23 mm. long exceeding tube of corolla, very pubescent toward the 4 subregular lobes,

6-8 mm. long, white-tipped; corolla white with prominent purple spots on the lower lip, pubescent, narrow throughout, 10-25 mm. long, lower lip shallow, 3-4 mm. long, teeth 1 mm. long, linear or obtuse; galea equaling teeth or exceeding them by not more than 1 mm., 4.5 mm. long, 3.5 mm. wide at base, subulate; longer pair of stamens syngenesious, anthers 0.5-1 mm. long, filaments free 3-4 mm., glabrous; pistil glabrous, stigma within galea, slightly two-lobed, less than 1 mm. wide; capsule elliptical, 6-10 mm. long, 3-5 mm. wide; seeds less than 1 mm. long, brown, smooth, in a loose-fitting reticulate coat.

Distribution: this common species is widely spread from British Columbia to southern California and adjacent Lower California, found along the coast and west of the Sierras. *Type locality*: Corte Madera, Marin County, California. BRITISH COLUMBIA: Vancouver Island, near Victoria, *Anderson in 1903, in 1912, in 1924* (WS). WASHINGTON: Whidbey Island, *Gardner 225* (WS, UC); American Lake, *Flett 2123* (WS). OREGON: Salem, *Nelson 2179* (G); Gold Beach, Curry County, *Hoyt 69* (St); Grant's Pass, *Heller 10019* (G, St). CALIFORNIA: Yreka, *Butler 1314* (Po, RM, UC, St), *Greene 786* (G); Eureka, *Chandler 1141* (G, UC, St); Ukiah, *Jones in 1924* (Po); Iron Canyon, Butte County, *Bruce 2087* (Po); Auburn, *Ames in 1895* (G); Mokelumne Hill, Calaveras County, *Blaisdell* (G, CA); Calistoga, *Baker 1993* (RM, Po, G, UC); Corte Madera, *Bigelow in 1854* (type, G); Stanford University, *Baker 545* (Po, WS, RM, G, UC); Mariposa, *Congdon in 1883* (St); Guernsey, Kings County, *Eastwood 3907* (G, CA); Three Rivers, *Abrams 10802* (Po, St); Bakersfield, *Munz 9028* (Po); Keene Station, *Heller 7817* (G, UC, St); Paso Robles, *Barber A16* (UC); Morro Creek, Santa Lucia Mountains, *Munz 9203* (Po); Santa Ynez Mountains, *Elmer 3835* (Po, G, UC); Santa Barbara, *Elmer 3835* (St); Cuyamaca Lake, *Munz 9764* (Po); Campo, *Parish 409* (G). LOWER CALIFORNIA: Hansen's Ranch, *Orcutt 1131* (G); Santa Catalina Mountains, *Orcutt in 1884* (UC).

This species shows the same peculiarity of range exhibited by *O. densiflorus* var. *gracilis* coming south as far as Santa

Barbara County along the coast and passing by the intervening territory to reappear in the mountains of San Diego County. (See discussion under *O. laciniatus*.)

11. ***Orthocarpus laciniatus*** (H. & A.), comb. nov.

Castilleja laciniata H. & A., Bot. Beech., 40, 1830. *Oncorhynchus pinnatifidus* Lehm., Ind. Sem. Hort. Hamb., 1832. *Oncorhynchus tenellus* Fisch. & Mey., Ind. Sem. Hort. Petrop. 1:35, 1835. *Orthocarpus australis* Benth., in DC., Prod. 10:537, 1846. Wats., Bot. King's Exp., 459, 1871.

Annual, erect or ascending, stems strict or branched, pilose, 1.5-2.5 dm. high; leaves linear or linear-lanceolate, lower entire, upper pinnatifid with 2-4 linear-filiform divisions, sparingly short-hispid, 1.5-3 cm. long; spike narrow, lax below; bracts 2-3 cm. long, lanceolate with 3-5 divaricate, linear, attenuate divisions, acute, green or with tips colored; calyx 1.5-2 cm. long, cleft halfway with 4 subregular, linear lobes, soft-pubescent; corolla purplish, narrow, 14-20 mm. long, lower lip shallowly 3-saccate, teeth 1.5 mm. long, oblong, erect, purple at base, galea exceeding lower lip 1.5-2mm., purplish, slightly falcate and abruptly narrowed at tip, puberulent to pubescent on back, densely pubescent within, margins wide, scarious, glabrous; anthers 1.5 mm. long, glabrous, filaments ciliate, pistil included in the galea, stigma globose; capsule oval, 8-12 mm. long; seeds many with brown loose-fitting reticulate coats.

Distribution: Andes Mountains, Peru and Chile. *Type locality*: in the Andes of Peru at Huamontango (*Mathews 4601*). PERU: Huamontango, *Mathew & Parker* (G); Orbajillo, *Wilkes in 1834-42* (G). CHILE: Santiago, (Brandegee Herbarium, UC).

Scarcely enough material was available of this species to accurately place its relationship. The collections that I have examined give but little clue as to the original color of the spikes or flowers. However, the species is apparently an inconspicuous one in the field. Its closest North American relative undoubtedly is *O. attenuatus*.

The oldest specific name for this material is *laciniatus* which, as *Castilleja laciniata*, Bentham reduced to synonymy under his species *australis*. The necessary new combination

was not discovered before the chart had been incorrectly printed as *australis*.

As this paper is in press, two collections of *Orthocarpus* from Chile come to me through the kindness of Dr. I. M. Johnston, of the Gray Herbarium. These plants seem identical with *O. attenuatus* and differ from the single sheet of *laciniatus* now at hand, namely, the one from Santiago. The latter plant has pinnatifid divisions to the leaves and bracts, red-violet corollas and stems, and the galea protrudes beyond the lower lip at least 2 mm. The specimens just received, however, have palmate lobing of the leaves and bracts, yellowish white corollas, and the galea does not exceed the teeth of the lower lip more than 1 mm. There are other minor differences that separate these so that *laciniatus* can not be referred to the species *attenuatus*. Possibly these two collections are of *attenuatus* that has been introduced into South America. The collections are: Chile: Ceno Cruz, Limache, Prov. Valparaiso, *G. Looser* 7 (G); Centinela, San Fernando Cerro, Prov. Colchagua, *Montero* 48 (G).

12. *Orthocarpus luteus* Nutt., Gen. Am. 2:57, 1818.

Gray, Syn. Fl. 2:301, 1878; 2:301, 1886. Coult. & Nels., Man. Rocky Mountains, 461, 1909. Jepson, Man. Calif., 944, 1925. *Orthocarpus strictus* Benth., Scroph. Ind., 13, 1835.

Stems erect, strict, usually simple or branching near the top, pubescent, 1-3.5 dm. high or a single specimen may be 6.5 dm. high; leaves of compact habit, sessile, linear or linear-lanceolate, pubescent, usually entire, dark green, 1.5-4 cm. long; spike more condensed than the leaves below, quite herbaceous, 1-25 cm. long; bracts 10-15 mm. long, 3-lobed, occasionally 5-lobed, the central lobe ovate or lanceolate-ovate, the small divergent lateral lobes *ca.* half the length of middle lobe, glandular-pubescent, dark green; calyx half as long as corolla, thin, glandular-pubescent, 6-8 mm. long, lobes subequal, acute, 2-3 mm. long; corolla golden-yellow, 10-12 mm. long, lower lip pubescent, simply saccate, not much larger than galea, 3.5-4 mm. long, 3 mm. wide, teeth minute, galea slightly glandular-pubescent, *ca.* 4 mm. long, *ca.* 4 mm. wide,

margins incurved and terminating in a minute hook, equaled by lower lip, obtuse; stamens paired, anthers pubescent, 2-celled, cells equal, boat-shaped, 1 mm. long; pistil inserted within galea, glabrous, stigma small only slightly wider than style; capsule elliptical, 5-7 mm. long, 3-4 mm. wide; seeds several, with tight-fitting yellow-brown reticulate wrinkled coats, 1-1.25 mm. long.

Distribution: the common yellow species of the Rocky Mountains and the most widespread found from 3500-9500 feet altitude and extending from the Canadian Rockies, to eastern Washington and California, into Arizona and New Mexico and northeast to the Dakotas. *Type locality*: "On the plains of the Missouri." SASKATCHEWAN: *Bourgeau* (G). ALBERTA: Rosedale, *Moodie 1070* (G, St); Banff, *Prince in 1900* (G). BRITISH COLUMBIA: Comex District, *Anderson 780* (WS). WASHINGTON: Usk, *Kreager 359* (G, WS); Revere, Whitman County, *Eastwood & St. John in 1925* (WS, Po). OREGON: Cscan Marsh, *Cusick 2742* (WS, RM, UC, Po, G); Crater Lake, *Coombe in 1913* (G, CA). CALIFORNIA: Goose Lake Valley, *Austin 537* (in part, Po); Vinton, Plumas County, *Heller & Kennedy 8884* (G, St); near Sonora Pass, Mono County, *Congdon in 1898* (UC). NEVADA: Deeth, Elko County, *Heller 10559* (G, St); King's Canyon, Ormsby County, *Baker 1430* (Po, G, UC). IDAHO: Silver City, *Macbride 431* (G, RM, WS); Picabo, *Macbride & Payson 3019* (RM, St, G); Victor, *Merrill & Wilcox 1235* (G, RM). UTAH: Park City, *Jones 2149* (RM, Po); Pine Flats, *Walker 351* (G, RM); Mendon, *C. Piper Smith 1815* (RM, CA, St); La Sal Mountains, *Purpus 7046* (Po, UC). ARIZONA: San Francisco Peak, *MacDougal 377* (RM, G, UC); Flagstaff, *Jones 3983* (Po, G). NEW MEXICO: Ft. Wingate, *Mathews 46* (G); Mogallon Mountains, Socorro County, *Metcalfe 530* (RM); Raton, *Diehl 352* (Po). COLORADO: Durango, *Baker, Earle & Tracy 604* (RM, Po, G); Pagosa Springs, *Baker 589* (WS, Po, G); Gunnison, *Baker 563* (WS, G, Po, UC, RM); Grizzley Creek, Larimer County, *Goodding 1872* (RM, G, UC, St). WYOMING: 15 mi. S. W. of Laramie, *Merrill & Wilcox 1166* (RM, G); Boyd, *Nelson 9440* (Po, St, G, RM); Sheridan, *Nelson 8481*

(RM); Yellowstone National Park, *Nelson 6183* (G, Po, UC, St, RM, WS). MONTANA: Browning, *Jones in 1909* (Po); Sedan, *B. J. Jones in 1901* (G). SOUTH DAKOTA: Black Hills, *Forwood in 1887* (G); Bixby, Perkins County, *Visher 622* (RM). NORTH DAKOTA: Leeds, *Lunell in 1900* (G), *in 1901* (RM), *in 1902* (St); Dickinson, *Holgate in 1908* (G); Svea, *Fieldstad 420* (RM).

13. *Orthocarpus tolmiei* Hook. & Arn., Bot. Beech., 379, 1836-1838.

Gray, Syn. Fl. 2:301, 1878; 2:301, 1886. Coult. & Nels., Man. Rocky Mountains, 462, 1909.

An erect branching annual with slender stems, puberulent, 1-3.5 dm. high; leaves sessile, linear, almost acuminate, puberulent, 1-4 cm. long; spike racemose, moderately compact, 2-10 cm. long; bracts 8-15 mm. long, 3-lobed, lateral lobes considerably smaller, divergent, narrowly lanceolate, central lobe lanceolate, glandular-pubescent, green; calyx half as long as corolla, lobes subequal, deltoid, 2-2.5 mm. long, calyx 6-8 mm. long; corolla yellow, 10-13 mm. long, lower lip simply saccate, glabrous, not much larger than galea, teeth inconspicuous, lip 4-5 mm. long; galea pubescent within, glabrous without, edges turned in, tip inflexed, cucullate, exceeding lower lip 1-2 mm., 4-5 mm. long, 3-4 mm. wide at base; stamens included in galea, filaments glabrous, free 4-5 mm., anthers boat-shaped, 1.25-1.75 mm. long, often ciliate; pistil included in corolla, stigma the slightly flattened tip of style; capsule glabrate, obovate, 3.5-7 mm. long; seeds few, plump, black-brown, 1.5-3 mm. long, coat tight-fitting, reticulate, ridged.

Distribution: this mountain species is much more restricted in range than the preceding being found at higher altitudes, 7500-10,500 feet, from southeastern Idaho to western Wyoming and Utah. *Type locality*: Snake Country. IDAHO: Montpelier, *Nelson 9108*, *9108a* (RM). WYOMING: Evanston, *Nelson 3838* (G, RM, CA); Teton Pass Mountains, *Payson 2072* (G, CA, RM); Coal Creek, Teton Range, *Hall 11442* (UC); Gros Ventre Mountains, *Payson 3044* (G, RM); Big Piney, *Payson 2610* (G, Po, UC, RM); Sheep Mountain, *Payson & Armstrong 3443* (RM); Red Mountain,

Payson & Armstrong 3651 (RM). UTAH: Park City, *Jones in 1881* (RM); Logan, *C. Piper Smith 2235* (RM, CA, St); Wahsatch Mountains, *Watson 814* (G), *Jones 1115* (Po); City Creek Canyon, Salt Lake City, *Jones in 1880* (Po); Big Cottonwood Canyon, *Cooper 360* (RM), *Garrett in 1904* (G); Parley's Park, *Clemens in 1900* (RM), *Watson 814* (G); Altus, *Clemens in 1908* (G, St); American Fork Canyon, *Hooker & Gray in 1877* (G); Mt. Nebo, *Rydberg & Carlton 7591* (RM, G); Deer Creek, *Jones in 1880* (Po, St); Fairview, *Jones 56270* (Po); Marysvale, *Jones 5893* (Po, UC). Snake Country, *Tolmie* (probably type collection, G).

14. *Orthocarpus purpureo-albus*, Gray ex Wats., Bot. King's Exp. 458, 1871.

Gray, Syn. Fl. 2:301, 1878; 2:301, 453, 1886. Coult. & Nels., Man. Rocky Mountains, 462, 1909.

Stems erect, simple or branching above, glandular-pubescent, purplish, 1-4 dm. high; leaves filiform or linear, sessile, alternate, glandular-pubescent, 1.5-3.5 cm. long, simple or 3-lobed, lateral lobes equaling mid-lobe, green; spike loose, few- to many-flowered, herbaceous, 3-25 cm. long; lower bracts equaling corolla, 10-20 mm. long, 3-lobed from near the base, lateral lobes nearly equaling mid-lobe, glandular-pubescent, green; calyx less than half the length of tube of corolla, glandular-pubescent, 7-9 mm. long, lobes sub-regular, prominent green stripe down middle of each lobe, margins scarious, acute; corolla white or purplish, well exerted, 15-20 mm. long, tube nearly twice as long as lower lip, pubescent, lower lip simply saccate, thin, expanding from throat, much larger than galea, glabrous, 7-9 mm. long, 4-5 mm. across, no teeth; galea exceeding lower lip *ca.* 1 mm., strongly pubescent margins, tip inflexed, uncinat; anthers 1.5-2 mm. long, cells boat-shaped, ciliate, filaments glabrous, free 5-6 mm.; pistil included in galea, very short, slightly exceeding throat, style 11-15 mm. long, stigma but slightly wider than style, small; capsule narrowly elliptical, 5-7 mm. long; seeds 8-10, rather close-fitting alveolar coat, angled, 2-2.5 mm. long.

Distribution: found in the Rocky Mountains up to 9500 ft. Colorado to northern New Mexico and Arizona. *Type lo-*

cality: New Mexico. UTAH: Kanab, *Thompson* (G); Monticello, *Rydberg & Garrett 9673* (RM). COLORADO: Piedra, *Baker 590* (Po); Durango, *Eastwood in 1892* (St); Iron Springs Mesa, *Walker 504* (Po, G, RM); Mesa Verde National Forest, *Haas 70* (RM); Uncompahgre Divide, *Payson 126* (RM, G). NEW MEXICO: *Parry in 1867* (probably one of type specimens, G); Silver City, *Snow 6444* (RM, UC), *6361* (St); Mogallon Mountains, Socorro County, *Metcalfc 417* (RM, UC, St, Po, G); Vallecitos, Rio Arribu County, *Eggleston 20480* (G); Beer Mountains, *Greene in 1880* (Po). ARIZONA: El Tovar, Grand Canyon, *Eastwood 3774* (CA); San Francisco Mountains, *MacDougal 381* (RM, UC, G), *Toumey 361* (St); Flagstaff, *Jones 3981* (Po, RM).

15. *Orthocarpus bracteosus* Benth., *Scroph. Ind.*, 13, 1835.

Erect slender stems, simple or branching above, pubescent, somewhat glandular, yellow, brown or purplish, 1-4 dm. high; leaves linear to lanceolate, 1.5-3.5 cm. long, green, glandular-pubescent, entire below, divided with two lateral lobes above, lobes linear-lanceolate; spike compact, blooming rather apically, 2-15 cm. long; bracts obtuse or rounded at base, green or tinged with purple, 10-20 mm. long, divided two-thirds of the way down by 2 or 4 lanceolate divaricate lobes, central lobe exceeding lateral lobes, widely lanceolate, acute, glandular-pubescent with soft hairs; calyx green, glandular-pubescent with long soft hairs, 6-10 mm. long; split half way down each side, these segments again cleft into acuminate lobes 2-4 mm. long; corolla white, pinkish lavender or bright purple, well exerted from the spike, 12-20 mm. long, tube longer than calyx, gradually swelling out into lower lip, lower lip covered with short, fine hair, simply saccate, no teeth, 5-7 mm. long; galea wide, scarcely exceeding lower lip, strongly pubescent, tip inflexed with inrolling, papery beak, 4-6 mm. long; anthers olive-green, boat-shaped with strongly inrolling margins, ciliate, anthers *ca.* 1.5 mm. long, filaments glabrous, 5-7 mm. long; pistil included in galea, stigma small,

less than 0.5 mm. in diameter; capsule brown, elliptical, 5-7 mm. long; seeds few, 2-3 mm. long, reticulated coat prominently ridged, not alveolar.

- A. Flowers rose-purple.....15a. var. *typicus*
 AA. Flowers white.....15b. var. *albus*

15a. *Orthocarpus bracteosus* var. *typicus*, nom. nov.

Orthocarpus bracteosus Benth., l. c. Gray, Syn. Fl. 2:300, 1878; 2:300, 1886. Jepson, Man. Calif., 944, 1925.

Distribution: this plant with deep-pink flowers is one of the most beautiful species. It is a valley inhabitant ranging from Vancouver Island, B. C., to northern California. *Type locality*: Columbia River. BRITISH COLUMBIA: Vancouver Island, *Kellogg 9* (G), *Diehl in 1902* (Po); Oak Bay, *Anderson in 1894* (WS), *Diehl 163* (Po); Victoria, *Macoun 724* (G), *Henry in 1911* (RM), *Fletcher in 1885* (G). WASHINGTON: San Juan Island, *Roush in 1919* (St); Falcon Valley, *Suksdorf in 1883* (St). OREGON: Salem, *Nelson 1617* (G), *252* (St); Monmouth, *Spillman 152* (WS); Willamette Valley, *Cusick 1497* (WS); Corvallis, *Gilkey in 1911* (RM), *Abrams 8726* (Po, St); Monroe, *Munz 9898* (Po); Des Chutes River, *Leiberg 595* (G, UC); Cscan Marsh, *Cusick 2743* (Po, G, UC, WS, RM); Calapooya Valley, *Barber in 1899* (RM, G); Silver Creek Falls, *Nelson 2246* (G); Klamath Valley, *Cronkhite in 1864* (G); Upper Klamath Lake, *Peck 7853* (G); Aspen Lake, *Copeland 3477* (G, Po, CA, UC, RM); Ft. Klamath, *Leiberg 661* (G, UC). CALIFORNIA: Upton, *Copeland 3897* (Po, CA, G); north-eastern Modoc County, *Manning 495* (UC); Plumus County, *Lemmon in 1875* (G).

15b. *Orthocarpus bracteosus* var. *albus*, var. nov.

Corolla white, stems yellow, herbage with yellowish cast, otherwise as var. *typicus*.

Type: Big Meadows, Des Chutes River, Oregon, July 26, 1894, *J. B. Leiberg 521* (Gray Hb.) Co-types at UC and CA.

Distribution: south-central Washington, north-central Oregon. WASHINGTON: Falcon Valley, Klickitat County, *Suksdorf 167* (G).

16. *Orthocarpus tenuifolius* (Pursh) Benth., Scroph. Ind., 12, 1835.

Gray, Syn. Fl. 2:300, 1878; 2:300, 453, 1886. Jepson, Man. Calif., 944, 1925. *Bartsia tenuifolia* Pursh, Fl. Am. Bor. 2:429, 1814. *Orthocarpus linearifolius* Benth., ex Gray, Proc. Am. Acad. 19:95, 1883.

Slender, simple or with erect branches, hirsute-pubescent, 1.5-3 dm. high; leaves 1-5 cm. long, linear with 2 or 4 divergent linear lobes, finely pubescent, somewhat ciliate below; spike dense, heavy, cylindric, 2-6 cm. long; bracts 10-20 mm. long, with 2 or 4 attenuate lateral lobes, middle lobe elliptical or ovate, obtuse or rounded, lower margin strongly ciliate with white flattened hairs, purplish tipped; calyx 7-12 mm. long, deeply cleft, the lobes shallowly 2-cleft, ciliate; corolla yellow or purplish at apex, pubescent, 14-20 mm. long, tube exceeding calyx, lower lip rather shallow, simply saccate, finely pubescent, teeth inconspicuous; galea exceeding lower lip *ca.* 1 mm., pubescent to the tip which is strongly inflexed; anther-cells boat-shaped, ciliate, anthers *ca.* 2 mm. long, filaments glabrous, free 6-7 mm.; style slightly scabrous-puberulent, more marked below, stigma small; capsule elliptical, brown, puberulent toward the tip, 5-9 mm. long; seeds several to many (29 ripe seeds in average one counted), *ca.* 1 mm. long, tight-fitting reticulate coat strongly ridged.

Distribution: a common species found at middle altitudes from Montana to eastern Washington and Oregon. *Type locality*: on the banks of Clark's River. MONTANA: Bozeman, *Moore in 1900* (Po, UC, St, RM); Helena, *Kelsey in 1891* (Po); Phillipsburg, *Titcomb in 1884* (G); Flathead Lake, *Elrod in 1907* (Po, St), *Jones in 1908* (Po); Ravalli, *Jones in 1909* (Po); Upper Marias Pass, *Jones in 1909* (Po); Big Hole Valley, *Watson in 1880* (G). IDAHO: Tamarack, *Clark 170* (G, St, RM); Moscow, *Abrams 744* (Po, UC, St); Lake Coeur d'Alene, *Aiton in 1892* (RM, Po). WASHINGTON: Omak Lake, *St. John 3535* (WS, Po); Grand Coulee,

Douglas County, *Cotton 618* (WS); Yakima Region, *Bran-degee in 1882* (UC); scab lands, Adams County, *St. John & Eastwood 13255, 13255a* (WS, CA, Po); Clark's Springs, *Kreager 18* (WS, G); Spokane, *Dewart* (WS); Rocklake, *Beattie & Lawrence 2348* (WS); Pullman, *Piper 1666* (WS, G), *Elmer 168* (RM, Po). OREGON: Colea Creek, Wal-lows County, *Sheldon 8265* (RM); Union, *Cusick 89* (G); Meacham, *Peck 5804* (G); Austin Ranch, E. Grant County, *Henderson 5678* (St); 5 mi. S. of Grass Valley, Sherman County, *Lawrence 375* (St).

17. ***Orthocarpus barbatus*** Cotton, Bull. Torr. Club, 29:574, 1902.

Piper, Contr. U. S. Nat. Herb. 11:518, 1906. Piper, Smith-son. Misc. Coll. 50:199, 1907.

Slender, erect, simple or with several erect branches, pilose, 8-25 cm. high; leaves 2-4 cm. long, scabrous-pubescent, entire or deeply 3- or 5-cleft with linear-attenuate lobes; spike closely imbricated, yellowish green, flowers 1.5-3 cm. long, nearly concealed by the bracts; bracts papery, ovate, acute, scabrate-puberulent, ciliate-margined, 10-18 mm. long, 5-12 mm. wide, 3- or 5-cleft with linear-lanceolate attenuate lobes; calyx 2-parted, its lobes cleft into 2 linear attenuate teeth *ca.* 4 mm. long, ciliate, becoming scabrous-puberulent on the teeth, 8-9 mm. long; corolla yellow, 10-12 mm. long, throat equalled by teeth of calyx, rather small lower lip nearly glabrous except for the pubescent margin, 4 mm. long, teeth 0.5 mm. long or less; galea straight, narrow, bearded at tip, extending beyond lower lip *ca.* 1.5 mm.; anther-cells elliptical, ciliate, upper cell of pair slightly larger, filaments glabrous, free 4 mm.; style glabrous, 6 mm. long, stigma small; capsule yellow-brown, ovate, acute at tip, scabrate-puberulent, 6-10 mm. long; seeds several, 8 mm. long with a yellow tight-fitting alveolar coat.

Distribution: a rare plant restricted to a small area in central Washington. *Type locality*: near Crab and Wilson Creeks, Douglas County. (This region is now included in Grant County.) WASHINGTON: near Crab and Wilson Creeks, Douglas County, *Sandberg & Leiberg 234* (Type col-

lection, G, UC); Wilson Creek, *Sandberg & Leiber* in 1893 (WS); east of Moses Lake, *Cotton 613* (WS); Soap Lake, Grant County, *St. John, Courtney, Parker 5000* (WS, UC).

18. *Orthocarpus cuspidatus* Greene, *Pittonia* 4:101, 1899.

Orthocarpus pachystachyus var. *cuspidatus* Jepson, Man. Calif., 945, 1925 (as to synonymy, not as to description). *Orthocarpus pachystachyus* of Jepson, Man. Calif., 945, 1925 (not of Gray).

Stems erect, stout, simple or branching midway, 1.5-3 dm. high, pubescent with short appressed hairs; leaves linear-lanceolate, 1-4 cm. long, usually parted to below the middle with 3 linear-attenuate lobes, scabrate-puberulent; spike heavy, cylindrical, compact, closely imbricated, 2-15 cm. long; bracts abruptly differing from the leaves, broadly ovate below with a pair of divaricate attenuate teeth, above broadly oval, nearly truncate, entire, sparsely ciliate-margined at base, otherwise nearly glabrous, purple and chartaceous, 12-20 mm. long, 8-12 mm. wide; calyx 8-12 mm. long, deeply parted into two lobes which are again cleft half way into two attenuate teeth, 4-5 mm. long, ciliate, papery below; corolla rose-purple with white or yellowish lower lip, much exceeding bracts, 20-25 mm. long, tube glabrous, wide, 5-6 mm. long, expanding into the much inflated lower lip which is 6-7 mm. long, 3-4 mm. deep, glabrate, the 3 narrow teeth 1 mm. long; galea arching, 10-12 mm. long, 5 mm. wide, exceeding lower lip 3-5 mm., puberulent, tip decidedly pubescent, 1 mm. deep; anthers 3-3.5 mm. long, cells boat-shaped, ciliate, filaments glabrous, free 10 mm.; style finely pubescent, extending to tip of galea, stigma inconspicuous; capsule ellipsoidal, 6-8 mm. long, brown; seeds black, few, 2 mm. long, with a tight-fitting alveolar coat.

Distribution: infrequent at middle altitudes in the Siskiyou Mountains of southern Oregon and California. *Type locality*: Ashland Butte, Siskiyou Mountains, southern Oregon. OREGON: Grizzly Peak, Jackson County, *Peck 5809* (Herb. of Willamette Univ.); Shake, *Austin 239* (UC); Ashland Butte, *Howell in 1887* (type collection, UC); Keno, Klamath County, *Peck 9373* (Herb. of Willamette Univ.), *9376* (G).

CALIFORNIA: Siskiyou Mountains, *Henderson 19* (G, St), 780 (UC, CA); Goosenest Foothills, *Butler 930* (Po, St, UC), 1584 (Po, RM, UC, St).

19. *Orthocarpus copelandi* Eastwood, Coult. Bot. Gaz. 41:288, 289, 1906.

Stems 1-3.5 dm. high, slender, simple or with several ascending branches above, purplish, covered with a short weak pubescence; leaves linear-lanceolate, 1-6 cm. long, entire below, cleft half way by two short attenuate teeth above, puberulent; spike compact, cylindrical, shortened often to a head, 1-9 cm. long; bracts similar to those in preceding species, 8-14 mm. long, 5-10 mm. wide; calyx as in *O. cuspidatus* with teeth 1.5-3 mm. long; corolla 10-15 mm. long, rose-purple with lower lip white or yellowish, tube glabrous rapidly expanding into throat, lower lip inflated, 4-6 mm. long, 2-4 mm. deep, glabrous without except on the inconspicuous teeth; galea 4-6 mm. long, 4-5 mm. wide at base, scarcely exceeding lower lip, pubescent without, straight; anthers 1.5-2.5 mm. long, cells boat-shaped, ciliate, filaments glabrous or pubescent, free 4-7 mm.; style pubescent near base, stigma inconspicuous, enclosed in galea; capsule elliptical, brown, 5-7 mm. long; seeds few to several, *ca.* 2 mm. long with tight-fitting compressed alveolar coat.

- A. Lower lip of corolla 3-4 mm. deep; spike usually crowded into a head; flowers extending well beyond the herbaceous bracts.....19a. var. *typicus*
 AA. Lower lip of corolla 2 mm. deep; spike elongated; flowers nearly hidden by the chartaceous bracts19b. var. *cryptanthus*

19a. *Orthocarpus copelandi* var. *typicus*, nom. nov.

Orthocarpus copelandi Eastwood, l. c. *Orthocarpus cuspidatus* of Piper, Smithson. Misc. Coll. 50:199, 1907 (in part). *Orthocarpus pachystachyus* var. *cuspidatus* Jepson, Man. Calif., 945, 1925 (as to description, in part).

Spike usually crowded into a head, flowers often divergent, extending well beyond the herbaceous bracts; bracts *ca.*

10 mm. long, 5 mm. wide. (*Jones in 1897* from Susanville, bracts 12 mm. long, 10 mm. wide); corolla 12-15 mm. long, lower lip 3-4 mm. deep; galea pubescent along groove within.

Distribution: a mountainous species from Josephine County, Oregon, south and east to Plumas and Lassen counties, California. *Type locality*: Mt. Eddy, altitude 7000 feet, Siskiyou County, California. OREGON: S. E. of Oregon Caves, *Peck 8376* (G, Herb. of Willamette Univ.). CALIFORNIA: Dorleska, Salmon Mountains, *Hall 8590* (Po, UC, G, RM, St); Salmon Creek, *Dudley in 1901* (St); Salmon River, *Alexander & Kellogg 256* (UC); Shackleford Creek, *Butler 1680* (Po, St, UC, RM), 53 (St, UC); Mt. Eddy, *Copeland in 1903* (type, CA), *Eastwood 1965* (CA, G), *Heller 12098* (G, St, CA), *Smith 537* (CA); Scott Mountains, *Greene 986* (G); N. side Mt. Shasta, *Brown 449* (UC, CA); head waters of the Sacramento River, *Pringle 88* (G, CA); Susanville, *Jones in 1897* (Po, CA); Red Clover Valley, *Heller & Kennedy 8700* (G, St).

19b. *Orthocarpus copelandi* var. *cryptanthus* (Piper), comb. nov.

Orthocarpus cryptanthus Piper, *Smithson. Misc. Coll.* 50: 200, 1907. *Orthocarpus pachystachyus* var. *cuspidatus* Jepson, *Man. Calif.*, 945, 1925 (as to description, in part).

Spike elongated, flowers nearly hidden by the closely imbricated chartaceous bracts; bracts 10-15 mm. long, 6-10 mm. wide; corolla 10-12 mm. long, lower lip 2 mm. deep; galea puberulent or glabrous along groove within.

Distribution: found above 4000 ft. from southeastern Oregon to the Yosemite National Park, California. *Type locality*: Stein Mountains, near Wild Horse Creek, Oregon. OREGON: Stein Mountains, near Wild Horse Creek, *Cusick 2035* (type collection, WS, UC, RM, G); Stein Mountains, opposite Andrews, *Leiberg 2531* (G, Po, UC). CALIFORNIA: Modoc County, *Gilman 560* (UC); Parker Creek, Modoc County, *Ferris & Duthie 93* (St); Mt. Bidwell, *Manning 286* (UC); Lassen Peak, *Lemmon in 1873* (G); Lassen County, *Austin in 1879* (G), *Stephens in 1894* (UC); Lake Canter Camp, Feather River, *Gillin 1921* (CA) Summit,

Brandegee in 1883 (UC), *in 1888* (St), *Greene 476* (G); Donner Lake, *Heller 6884* (Po, G, RM, UC, St); Soda Springs, *Jones 2603* (Po); Placer County, *Carpenter in 1892* (UC), *Sonne 277* (St), *in 1884, in 1887* (UC); Inspiration Point, Nevada County, *Dudley in 1894* (St); Truckee, *Sonne 402* (UC); Deer Park, Lake Tahoe region, *Eastwood 255* (G, CA); Tahoe City, *Kelley in 1923* (CA); Alpine County, *Hansen 455* (UC, St); Lundy, Mono County, *Congdon in 1894* (G, St), *Minthorn in 1908* (UC); Farrington's, near Mono Lake, *Eastwood in 1907* (CA); Piute Creek, Yosemite Park, *Reed 3462* (UC); Plateau above Muir Gorge, *Jepson 3385* (UC). NEVADA: Hunter Creek, Washoe County, *Kennedy 1611* (St, UC).

This species with its two varieties is very distinct from *O. cuspidatus*, with which it is most often confused, in having a corolla only 10-15 mm. long with a straight galea scarcely exceeding the lower lip as compared with the corolla 20-25 mm. long with the curved galea exceeding the lower lip by 3-5 mm. of *O. cuspidatus*. These two species, however, are certainly very closely related being similar in range, habit, flower color, bracts and other characteristics.

20. *Orthocarpus pachystachyus* Gray, Syn. Fl. 2:300, 1878.

Gray, Syn. Fl. 2:300, 452, 1886. Gray, Proc. Am. Acad. 19:95, 1883.

Small stout annual, stems simple or branching above, glandular-pubescent, 1.5-2.5 dm. high; leaves 1.5-3.5 cm. long, linear, entire or 3-5 linear-lobed, scabrous-puberulent; spike heavy, compact, flowers slightly extending from the closely imbricated bracts, 2.5-10 cm. long; bracts abruptly differing from the leaves, 3- 5- 7-lobed, 15-28 mm. long, rose-purple, middle lobe oblong-ovate, tip acute below or rounded above, 5-9 mm. wide, lateral lobes divergent, lanceolate, half as long as middle lobe, 8-15 mm. long, finely scabrous-puberulent or ciliate toward the base; calyx 15-20 mm. long, parted nearly to base in front, less than half way behind, each lobe bearing two lanceolate teeth 5-6 mm. long, puberulent, somewhat ciliate; corolla rose-purple, 20-30 mm. long, tube exceeding calyx, lower lip nearly glabrous except margins and rounded teeth

which are pubescent, galea exceeding lower lip 2-3 mm., incurved tip conspicuous, slender, glabrous or nearly so; anther-cells *ca.* 2 mm. long, narrow, curved, glabrous, filaments glabrous; style scabrous-puberulent, stigma small; capsule elliptical, yellow-brown, 5-7 mm. long; seeds several with tight-fitting finely alveolar coat, flattened, 3 mm. long.

Distribution: a rare plant of Siskiyou County, California. *Type locality*: plains of the shasta River. Siskiyou County: near Yreka, *Greene 813* (type collection, G, CA, UC); *Gazelle*, *Smith 267* (G, CA).

21. *Orthocarpus imbricatus* Torrey ex Wats., Bot. King's Exp., 458, 1871.

Gray, Proc. Am. Acad. 19:94, 1883. Gray, Syn. Fl. 2:452, 1886. *Orthocarpus tenuifolius* of Gray, in Bot. Calif. 1:577, 1876 (in part). *Orthocarpus olympicus* Elmer, Coult. Bot. Gaz. 36:60, 1903.

Erect, slender, simple or corymbosely branching above, stems puberulent, 2-3.4 dm. high; leaves linear or lanceolate, clasping the stem at base, glabrous or especially the margins finely puberulent, entire, 1-4 cm. long; spike short, compact, 1-4 cm. long; bracts abruptly differing from the leaves, entire or with two small lateral attenuate lobes below the middle, ovate or oblong, obtuse, rounded or with a small mucronate tip, finely puberulent, lower margins soft-ciliate, green, tipped with purple, 7-14 mm. long, 4-7 mm. wide; calyx 4-6 mm. long, deeply cleft before and behind, each lobe with two attenuate teeth *ca.* 1.5 mm. long, pubescent, scarious, green ribs; corolla purplish, partially concealed by bracts, 10-13 mm. long, tube twice as long as calyx, gradually expanding into throat, lower lip whitish, pubescent, 3-4 mm. long, simply saccate or 3-plicate, teeth small, narrowly deltoid, 1.5 mm. apart; galea triangular, exceeding lower lip *ca.* 1 mm., puberulent, margins inrolling, uncinuate, ending in a scarious tube; anther cells *ca.* equal, boat-shaped, ciliate, anthers 1.5 mm. long, filaments glabrous; pistil included, style scabrous-puberulent, stigma the slightly expanded tip of style; capsule oval, flattened; seeds few to several, tight-fitting reticulate coat, 2 mm. long.

Distribution: this rather uncommon species occurs in the mountains from Washington to northern California. The center of distribution is in California. *Type locality*: Cascade Mountains, Oregon. WASHINGTON: Olympic Mountains, Clallam County, *Flett 85* (WS), *Elmer 2574* (type collection for *O. olympicus*, St, WS, CA). OREGON: Cascade Mountains, *Newberry* (type collection, G), *Rose 215*, in 1909 (St); Smith River, Linn County, *Sheldon 512661* (St); 18 mi. W. of Crater Lake, *Peck 5769* (G); Buck Lake, *Aplegate 389* (G). CALIFORNIA: Ager, Siskiyou County, *Furlong in 1901* (UC); Mt. Shasta, *Palmer 2435* (Po), *Congdon in 1900* (UC); McCloud, *Eastwood 1066* (G, CA), *Condit in 1911* (UC); between Bigelow's and McCloud River, *Eastwood 10855* (CA); Nabar, Del Norte County, *Dudley in 1899* (St); Tamarack Road, Shasta County, *Baker 349* (UC); Trinity Summit, *Manning in 1899* (UC); Redwood Creek, Humboldt County, *Chesnut & Drew in 1888* (UC).

22. *Orthocarpus erianthus* Benth., Scroph. Ind., 12, 1835.

Stems simple or more commonly with many branches, divergent above, divaricate or ascending below, puberulent or with short glandular pubescence, 0.5-3.5 dm. high; leaves 1-5 cm. long, linear, clasping stem at base, pinnately divided toward tip with many filiform divisions, glabrous or glandular-pubescent; spike 2-15 cm. long, more compact above, corollas well exerted; bracts 5-18 mm. long, usually half the length of corolla or below equaling the corolla, glabrous to glandular-pubescent, divided into 4-10 linear divisions; calyx 5-8 mm. long, pubescent, 4 subregular lanceolate teeth; corolla 10-25 mm. long, tube long, slender, densely pubescent, lower lip abrupt, prominently 3-saccate, glabrous without, bearded within; galea red-purple, equaling or slightly exceeding lower lip, narrow, subulate, straight or curved; anthers coherent in pairs, cells shallow; pistil glabrous, stigma *ca.* equaling galea; capsule 4-8 mm. long, oblong, brown; seeds many, with reticulate coats.

- A. Lower lip 3-5 mm. deep.
 B. Corolla at least partly yellow, lower lip 3-4 mm. deep.
 C. Lower lip yellow.....22a. var. *typicus*
 CC. Lower lip with two lateral sacs white, the middle one yellow.....22b. var. *gratiosus*
 BB. Corolla white turning rose-pink, lower lip 4-5 mm. deep22c. var. *roseus*
 AA. Lower lip 2 mm. deep.....22d. var. *micranthus*

22a. *Orthocarpus erianthus* var. *typicus*, nom. nov.

Orthocarpus erianthus Benth., l. c. Gray, Syn. Fl. 2:301, 1878; 2:301, 453, 1886. Jepson, Man. Calif., 941, 1925. *Orthocarpus bidwelliæ* Gray, Proc. Am. Acad. 15:51, 1879. Gray, Syn. Fl. 2:453, 1886. Jepson, Man. Calif., 942, 1925.

Herbage pubescent; corolla conspicuous, galea slightly curved, purple, lower lip yellow with a purple band around the throat, 3-4 mm. deep.

Distribution: a plant of the fields occurring commonly from the upper Sacramento Valley to Tulare County and from Del Norte County to San Luis Obispo County; occurring rarely in southern California. *Type locality*: probably near Monterey. CALIFORNIA: Douglas (probably type collection, G); Adams Stations, Del Norte County, *Eastwood 131* (CA); Humboldt County, *Marshall in 1888* (UC); Redding, *Baker 24* (UC); Red Bluff, *Jones 244* (G); Chico, *Copeland 3036* (Po, UC, CA, RM, G), *Bidwell in 1878* (type for *O. bidwelliæ*, G); Marysville, *Heller 7566* (G, St, UC); Auburn, *Ames in 1891* (Po, UC, G); Ione, *Eastwood 10068* (CA, G); Potter Valley, *Purpus 3093* (UC); Clear Lake, *Peirson 6587* (Po); Santa Rosa, *Heller & Brown 5219* (RM, G, Po, St); Vallejo, *Greene 110* (G); Stockton, *Sanford 166* (UC); Livermore, *Heller 7315* (RM, G, St, UC); Palo Alto Stock Farm, *Burnham in 1894* (Po); Mt. Hamilton, *Baker 633* (Po, G, WS, UC, CA); Santa Cruz, *Elmer 4491* (Po, CA, UC, St); Fremont's Peak, San Juan, *Elmer 4906* (Po, CA, St); Jolon, *Eastwood 4079* (CA); San Luis Obispo, *Munz 9235* (Po); Arroyo Grande, *Brewer 437* (G, UC); Mariposa County, *Eastwood 4262* (G, CA); Lindsay, *Munz 9042* (Po);

Ventura County, collector unknown (St); Tejunga, Los Angeles County, *Wilder* (St); Foster's, San Diego County, *Brandegee* in 1906 (UC).

In the springtime typical *O. erianthus* often brightens entire fields with yellow. This species and *O. purpurascens* are the two most plentiful in California. This variety is replaced for the most part by others along the coast. It has been introduced into Washington: West Seattle, *Piper* 552 (G). The material from the Sacramento Valley, which Gray named *O. bidwelliæ*, can not be separated from that of the Coast Ranges. The looseness of the seed coat, size of corolla, and pubescence, which were Gray's distinguishing characters, are variable.

22b. *Orthocarpus erianthus* var. *gratiosus* Jepson & Tracy, Man. Calif., 941, 1925.

Lower lip of corolla with middle lobe yellow, two lateral lobes white, purple band prominent about throat.

Distribution: coastal, Curry County, Oregon and Humboldt County, California. *Type locality*: Eureka. OREGON: Port Orford, *Peck* 8477 (G); Gold Beach, *Abrams & Benson* 10666 (St). CALIFORNIA: Humboldt Bay region, *Tracy* 2019 (RM, G, St), 2040 (UC), *Chandler* 1142 (G, St, UC), *Jones* in 1924 (Po), *Hutchinson* in 1913 (CA), *Bohmannson* in 1907 (CA); Kneeland Prairie, *Tracy* 2477 (UC).

In the older herbarium specimens of this variety the lower lip appears uniform in color. In the field the plants are decidedly distinct from var. *typicus*. The Oregon material cited above appears to be this variety although the color of each sac of the lower lip was not discernible. A sheet from Eureka, *Tracy* 2035 (UC), which is given as the type number, is undoubtedly a hybrid between this variety and *O. pusillus*. Jepson has told me that the type sheet for var. *gratiosus* was *Tracy* 2035 in the U. C. Herbarium. This is certainly an error in citation for Tracy distinctly labels this sheet as a hybrid between var. *gratiosus* and *O. pusillus*.

22c. *Orthocarpus erianthus* var. *roseus* Gray, in Bot. Calif. 1:578, 1876.

Gray, Syn. Fl. 2:301, 1878; 2:301, 453, 1886. Jepson, Man. Calif., 941, 1925. *Triphysaria versicolor* Fisch. & Mey., Ind. Sem. Hort. Petro., 2:52, 1836. *Orthocarpus versicolor* Greene, Man. Bot. S. F., 283, 1894. *Orthocarpus versicolor* var. *roseus* Greene, Man. Bot. S. F., 283, 1894. *Orthocarpus erianthus* var. *versicolor* Jepson, Fl. West. Mid. Calif., 415, 1901. Jepson, Man. Calif., 941, 1925. *Orthocarpus erianthus* var. *inopinus* Jepson, Man. Calif., 941, 1925.

Lower lip of corolla rose-pink or white turning rose-pink, 4-5 mm. deep. Otherwise as var. *typicus*.

Distribution: the common form near the ocean from Mendocino County to San Benito County, California; occasional to Del Norte County. *Type locality*: Port Bodega, Sonoma County. CALIFORNIA: Gasquet, Del Norte County, *Howell 1469, 1470* (UC); Noyo, *Bolander 4722* (UC, G); Mendocino, *Brozen 700* (type for *O. erianthus* var. *inopinus*, UC); near Stewart's Point, *Baker in 1898* (UC); Bodega Bay, *Wrangell* (G); Bodega Point, *Eastwood in 1899* (RM, G), *4858* (G, CA); San Francisco County, *Babcock in 1902* (Po, RM, St); South San Francisco, *Elmer 4670* (Po, St, UC, CA); San Bruno Hills, *Baker 1896* (G, UC, CA, Po, RM); Aromas, San Benito County, *Eastwood 4188* (G, CA).

All gradations occur between the larger plants with white flowers which later turn pink and the smaller ones which produce pink flowers.

22d. *Orthocarpus erianthus* var. *micranthus* (Gray) Jepson,* Man. Calif., 941, 1925.

Orthocarpus bidwelliae var. *micranthus* Gray, Syn. Fl. N. Am. 2:453, 1886. *Orthocarpus micranthus* Greene ex Heller, *Muhlenbergia*, 2:251, 1906.

Herbage pubescent; corolla 8-15 mm. long, lower lip ca. 2 mm. deep, yellow; stamens exserted from galea, separate.

* Jepson reduced Greene's species *micranthus* to varietal rank under *erianthus*. Examination of the type of *bidwelliae* var. *micranthus* Gray shows it to be the same as Greene's type. Since Gray's name has priority the variety is accredited as (Gray) Jepson.

Distribution: open fields, Mariposa County to Tulare County, west to eastern Monterey County, California. *Type locality*: plains of Fresno County. Danah Road, Mariposa County, *Congdon in 1889* (G, St); Snow Creek Road, *Congdon in 1886* (G); Mariposa County, *Congdon in 1889* (G); Pollasky, *Heller 8169* (type collection for *O. micranthus*, G, St, UC, CA); plains of Fresno County, *Green in 1884* (type collection, G, UC); Big Sandy Creek, Fresno County, *McDonald in 1915* (CA); Priest Valley, Monterey County, *Eastwood in 1893* (UC); Jolon, *Eastwood 4086* (G, CA); Santa Lucia Mountains, *Ferris 1802* (St); Badger Road, Tulare County, *Kelley in 1919* (UC); Three Rivers, *Abrams 10799* (Po); Lindsay, *Munz 9043* (Po); Porterville, *Kelley in 1922* (CA); Richgrove, *Munz 9013* (Po).

23. *Orthocarpus faucibarbus* Gray, *Pacif. Rail. Rep.* 4:121, 1856.

Syn. Fl. 2:302, 1878; 2:302, 1886. Jepson, *Man. Calif.*, 941, 1925. *Orthocarpus erianthus* var. *laevis* Gray, *Syn. Fl.* 2:453, 1886.

Stems 1-4.5 (-6) dm. high, simple or usually corymbosely branched, straw-colored, glabrous or nearly so to the inflorescence where they become puberulent; leaves 2-8 cm. long; bracts and calyx similar to those of the preceding species; corolla clear yellow or whitish often fading pinkish, galea lighter than in the preceding, yellowish on the ridge becoming purple toward the margins, lower lip yellow or white with 6-12 purple dots on each margin, tube slender, densely pubescent, lower lip varies from 2-4 mm. deep, bearded within, teeth less than 1 mm. long; other characters similar to those of the preceding species.

Distribution: coastal valleys from southern Oregon to Monterey County, California. *Type locality*: Corte Madera, Marin County, California. OREGON: between Bandon and Langlois, *Abrams & Benson 10635* (RM, St). CALIFORNIA: Crescent City, *Howell 1469* (RM); Trinidad, *Tracy 3237* (UC); Humboldt Bay, *Chandler 1101* (G, UC,

St); Noyo, *Bolander 6537* (G, UC); Willits, *Jones in 1924* (Po); Fort Ross, *Heller 6607* (G, Po, RM, UC, St); Calistoga, *Baker 2632* (Po, CA, G, UC); Santa Rosa, *Heller & Brown 5292* (Po, RM, G, St); Vallejo, *Greene 379* (G); Lagunitas, *Eastwood 42* (G); Corte Madera, *Bigelow in 1854* (type, G), *Heller 7365* (RM, G, St, UC); San Francisco, *Jones 3267* (Po, CA, RM); Mission Hills, *Bolander 6301* (G); W. of Watsonville, *Baker 1955* (Po, UC, CA, RM, G); Castroville, *Elmer 4474* (Po, CA, St).

Gray, who first described this species, later reduced it to a variety under *O. erianthus*. Indeed this plant is closely related to *erianthus*, but here it is retained as a separate species because it differs in several specific characters, whereas the varieties of *erianthus* here recognized are based upon fewer differences. The two species most closely approach each other through *O. erianthus* var. *roseus*. In British Columbia, where this species has probably been an introduction, it approaches that variety. The British Columbia plants are smaller than the California material: Victoria, *Henry 6501* (RM); Oak Bay, Vancouver Island, *Anderson in 1896* (WS), *Macoun 87709* (G), *Gardner in 1901* (UC).

24. *Orthocarpus pusillus* Benth., *Scroph. Ind.*, 12, 1835.

A slender plant, 4-20 cm. high, with many weak ascending branches from the base, main stem obscure, herbage hispidulous-pubescent, with a purplish cast; leaves linear, 10-30 mm. long, with 2-8 lateral filiform divisions; spike elongated, often flowering from base of stem, flowers scattered; bracts 5-12 mm. long, once or twice pinnatifid with 3-7 filiform divisions, exceeding the flowers; calyx 5-7 mm. long with 4 subequal attenuate teeth, becoming papery on the fruit; corolla red-purple, occasionally yellow, 4-6 mm. long, inconspicuous, early shed off expanding ovary, tube yellowish, glabrous, lower lip nearly glabrous, 1.5-2 mm. long, shallow, trisaccate, teeth inconspicuous; galea uncinata, exceeding lower lip 0.5 mm., sparingly pubescent; anthers early exerted from galea, 0.5 mm. long, somewhat pubescent, filaments free

1-1.5 mm.; style glabrous, stigma capitate; capsule 4-6 mm. long, subspherical, flattened, light brown; seeds many, black, with tight-fitting reticulate coat.

- A. Herbage deep green becoming purplish.....24a. var. *typicus*
 AA. Herbage a bright yellow-green, not at all purplish
24b. var. *densiusculus*

24a. *Orthocarpus pusillus* var. *typicus*, nom. nov.

Orthocarpus pusillus Benth., l. c. Gray, Syn. Fl. 2:301, 1878; 2:301, 453, 1886. Jepson, Man. Calif., 940, 1925.

Herbage deep green becoming purplish, often giving a purplish cast to the grassy places where it grows.

Distribution: British Columbia to San Luis Obispo County, California. *Type locality*: probably near San Francisco or Monterey, California. BRITISH COLUMBIA: Cedar Hill, *Anderson 690* (WS); Cowichan Lake, *Anderson 691* (WS); Victoria, *Henry 6500* (RM, CA). WASHINGTON: Prairie, *Flett in 1896* (WS); Seattle, *Piper in 1892* (G, WS); Port Townsend, *Elmer 2592* (WS, Po, St); Westport, *Grant in 1919* (G); Montesano, *Heller 3877* (WS, G, UC, RM). OREGON: Portland, *Sheldon in 1902* (Po, G, St, WS); Salem, *Nelson 2161, 1074* (G); Sauvie's Island, *Howell in 1876* (Po), *in 1893* (RM, UC); Cow Creek, Douglas County, *Abrams & Benson 10468* (St); Port Orford, *Peck 9064* (G); Grant's Pass, *Prescott in 1912* (G, St). CALIFORNIA: Douglas (probably type collection, G); Eureka, *Tracy 2166* (G, UC), *2167* (UC); Cherokee Mine, Butte County, *Heller 13106* (G, CA); Auburn, *Ames in 1895, in 1886, in 1891* (G); Sacramento, *Baker in 1900* (UC); Mokelumne Hill, Calaveras County, *Blaisdell* (G, CA); Ukiah, *Jones in 1924* (Po); Bennett Valley, S. E. of Santa Rosa, *Heller & Brown 5230* (Po, St, G, RM); Fairfax, *Michener & Bioletti in 1892* (RM, St, UC); Mt. Diablo, *Chandler 945* (Po, UC); San Francisco, *Heller 8440* (G, St); Stanford University, *Baker 498* (Po, WS, UC, RM, G); Castroville, *Heller 8490* (G, St); 10 mi. E. of Morro, *Munz & Keck 10203* (Po).

This plant seems undoubtedly to hybridize with *O. erianthus*. One of these apparent hybrids is from Navarro, Mendocino County, *Byrbee* in 1895 (UC). (See discussion under *O. erianthus* var. *gratiosus*.)

24b. *Orthocarpus pusillus* var. *densiusculus* (Gdgr.), comb. nov.

Orthocarpus densiusculus Gdgr., Bull. Soc. Bot. France 66:218, 1919.

Herbage distinctly yellow-green, otherwise as var. *typicus*.

Type collection the only material seen, taken on dry low ground, Bingen, W. Klickitat County, Washington, *Suksdorf* 5015 (WS, St).

25. *Orthocarpus floribundus* Benth., Scroph. Ind., 12, 1835.

Gray, Syn. Fl. 2:301, 1878; 2:301, 453, 1886. Jepson, Man. Calif., 940, 1925.

Stems erect, 1-3 dm. high, corymbosely branched from near the base, yellowish brown, sparingly pubescent; leaves 10-40 mm. long, pinnate above with many filiform divisions, nearly glabrous; spike compact, short, 1-5 (-10) cm. long; bracts 4-12 mm. long, pinnately 3-7 parted with linear attenuate lobes, scabridulus-puberulent, equaling tube of corolla below, only equaling calyx above; calyx 4-6 mm. long, cleft half way into two lobes, each lobe again cleft into a pair of acute teeth, usually glabrous except for scabridulus margins of teeth; corolla white or cream-colored, 10-14 mm. long, glabrous except for beard within lower lip, tube twice as long as calyx, lower lip with 3 divergent oblong sacs 2 mm. deep; galea equaling lower lip before the sacs reflex, papery, expanded, obtuse, slightly reflexed; stamens exerted from galea extending beyond its tip, anthers undulate, reflexed, ciliate, ca. 1 mm. long, filaments glabrous, equaling galea, stigma small, capitate; capsule brown, ovate, 4-5 mm. long; seeds many, black with tight-fitting reticulate coat.

Distribution: common in the fields of San Francisco and vicinity. *Type locality*: probably near San Francisco. CALI-

FORNIA: *Douglas* (probably type collection, G); Pt. Reyes, Marin County, *Eastwood in 1906, 4776* (CA); San Francisco, *Jones 3269* (Po, CA), *Heller 6595* (RM, Po, G, St, UC), *Kellogg & Harford 698* (G, CA), *Congdon in 1881* (St, UC), *Rattan in 1878, in 1884, in 1886* (St); Colma, *M.K.C. 68* (St); San Bruno Mountain, *Ferris 2134* (St), *Eastwood in 1919* (CA); South San Francisco, *Elmer 4522* (Po, CA, St), *Baker 346* (Po, G, UC, WS, CA, RM); Lake San Andreas, *Abrams 2321* (Po, St, G), *Baker 1926* (Po, UC, RM); Millbrae, *Davy 1028* (UC); Burlingame, *Eastwood in 1915* (CA); Belmont, *Dudley in 1897* (St); Seal Cave, *Dudley in 1900* (St).

EXCLUDED OR DOUBTFUL SPECIES

1. *Orthocarpus pallescens* Gray, Am. Jour. Sci. ser. 2, 34:339, 1862,=*Castilleja pallescens* Greenman, Bot. Gaz. 25:266, 1898.
2. *Orthocarpus parryi* Gray, Am. Natural. 8:214, 1874,=*Castilleja pallescens* Greenman, l. c.
3. *Orthocarpus pilosus* Wats., Bot. King's Exp., 231, 459, 1871,=*Castilleja pilosa* Rydb., Mem. N. Y. Bot. Gard. 1:361, 1900.
4. *Orthocarpus psittacinus* Eastw., Bull. Torr. Club 29:78, 1902,=*Castilleja*.
5. *Orthocarpus cinereus* Jepson, Man. Calif., 939, 1925,=*Castilleja cinerea* Gray, Proc. Am. Acad. 19:93, 1883.
6. *Orthocarpus schizotrichus* Jepson, Man. Calif., 940, 1925,=*Castilleja schizotricha* Greenm., Bot. Gaz. 53:511, 1912.
7. *Orthocarpus pilosus* var. *monensis* Jepson, Man. Calif., 940, 1925, is probably a variety under *Castilleja pilosa* Rydb., l. c. I have not studied any material of this variety.
8. *Orthocarpus pilosus* var. *arachnoideus* Jepson, Man. Calif., 940, 1925,=*Castilleja arachnoidea* Greenm., Bot. Gaz. 53:510, 1912.

9. *Orthocarpus mexicanus* Hemsl., Biol. Centr. Am. Bot. 2:463, 1882,=*Castilleja*.

10. *Orthocarpus beldingi* Greene, Bull. Calif. Acad., ser. 1, 3:123, 1885,=*Clevelandia beldingi* Greene, ex Brandege, Proc. Calif. Acad., ser. 2, 3:157, 1891.